

**Department of the Interior  
US Fish and Wildlife Service  
Bandon Marsh National Wildlife Refuge  
P.O. Box 99  
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Bandon, Oregon**

**Environmental Assessment**

**MetaLarv S-PT Treatment on the Ni-les'tun Unit to Control  
Salt Marsh Mosquitoes**

**November 2013**

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## GLOSSARY OF TERMS AND ABBREVIATIONS

a.i. or ai	Active Ingredient
BCF	Bioconcentration Factor
CAS	Chemical Abstracts Service
EEC	Estimated Environmental Concentration. The estimated pesticide concentration in an environment such as a terrestrial ecosystem.
K <sub>oc</sub>	Soil-water partition coefficient. The ratio of pesticide concentration in a state of sorption (adhered to soil particles) and the solution phase (dissolved in the soil water). Thus, the smaller the K <sub>oc</sub> value, the greater the concentration of the pesticide in solution. Pesticides with a small K <sub>oc</sub> value are more likely to leach into groundwater than those with a large K <sub>oc</sub> value. For example, values 4-5 and >5 are classified as hardly mobile and immobile, respectively.
LC <sub>50</sub>	Median Lethal Concentration. A statistically derived concentration of a substance that can be expected to cause death in 50% of test animals. It is usually expressed as the weight of substance per weight or volume of water, air or feed (e.g., mg/l, mg/kg or ppm).
LD <sub>50</sub>	Median Lethal Dose. A statistically derived single dose that can be expected to cause death in 50% of the test animals when administered by the route indicated (oral, dermal, inhalation). It is expressed as a weight of substance per unit weight of animal (e.g., mg/kg).
lbs	Pounds
LOC	Level of Concern
LOAEL	Lowest Observed Adverse Effect Level
LOEC	Lowest Observed effect Concentration
MetaLarv	MetaLarv (S-PT) is the trade name of a biorational pre-hatch insecticide manufactured by Valent BioSciences Corporation for control of mosquito larvae in floodwater areas. The active ingredient is (S)-methoprene. (S)-methoprene is a juvenile hormone analog of mosquitoes that prevents the emergence of adult mosquitoes.
mg/kg/day	Milligram Per Kilogram Per Day
mg/L	Milligrams Per Liter
NOAEC	No Observed Adverse Effect Concentration
NOAEL	No Observed Adverse Effect Level
NOEC	No Observable Effect Concentration
NOEL	No Observed Effect Level
mph	Miles Per Hour
ppb	Parts Per Billion
ppm	Parts Per Million
RED	Reregistration Eligibility Decision
Refuge	Bandon Marsh National Wildlife Refuge
RQ	Risk Quotient
S <sub>w</sub>	Water Solubility
Service	US Fish and Wildlife Service
US EPA	US Environmental Protection Agency

## I. Purpose and Need

In 2011, the U. S. Fish and Wildlife Service (Service), a team of cooperators, and experts in the field of Oregon tidal marsh ecology and restoration completed a 420-acre tidal marsh restoration project on the Ni-les'tun Unit of Bandon Marsh National Wildlife Refuge (NWR or Refuge). The restoration project involved, in part, the obliteration of 15 miles of agricultural ditches by disking, plowing, and filling along with the construction of 5 miles of new sinuous tidal channels (Figure 1). The perimeter dike and three water control structures were removed adjacent to the Coquille River to allow for full tidal flow across the historic and newly restored tidal marsh. During construction, depressions that impound tidal waters were inadvertently created where ditches were not adequately filled or where fill material settled, and in the tracks of haul roads used by heavy equipment on the site. These depressions continue to strand shallow water as higher monthly tides recede and provide breeding sites for mosquitoes.

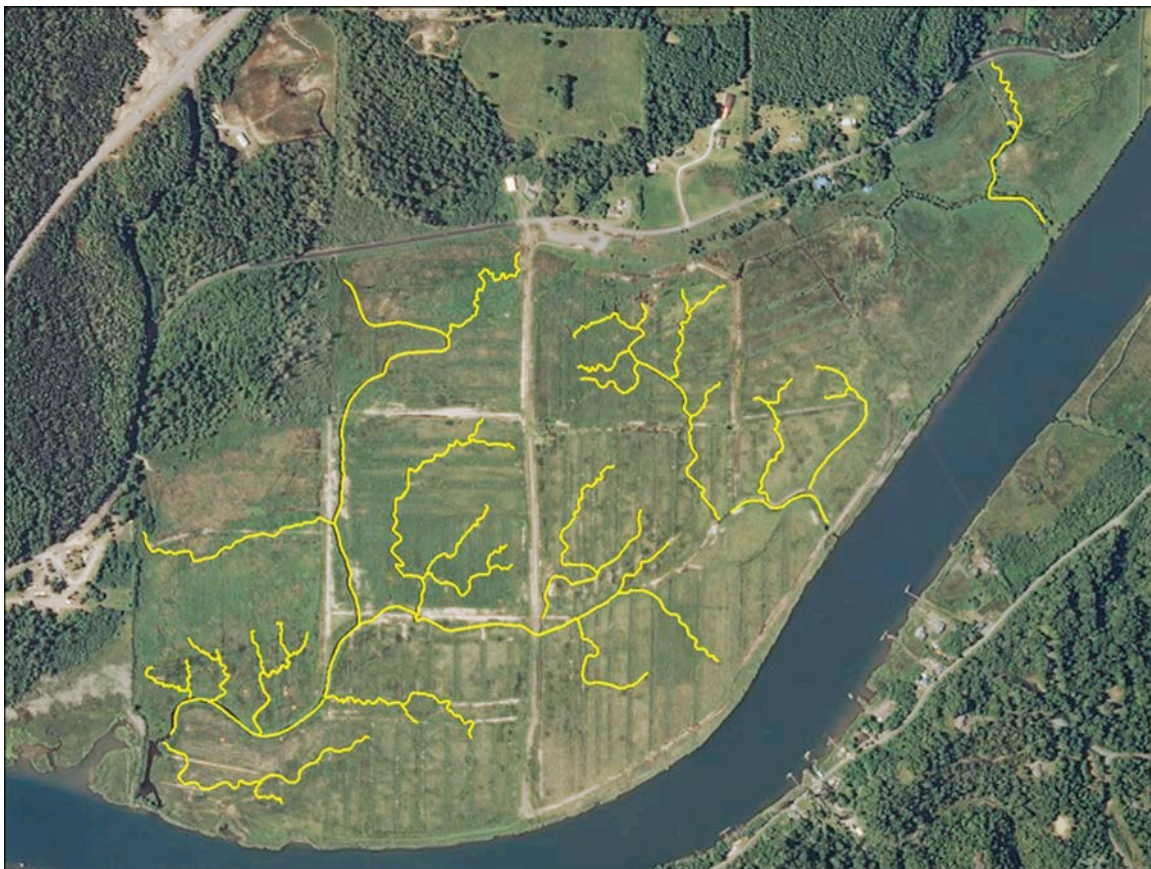


Figure 1. Aerial view of the Ni-les'tun Unit of Bandon Marsh National Wildlife Refuge. Yellow lines depict sinuous channels that were constructed, and filled agricultural ditches appear as straight green lines.

Refuge staff noted an increase in mosquito numbers within the newly restored salt marsh habitat in summer 2012 and received several telephone calls and one letter describing increased mosquito numbers from landowners directly across the river from the Ni-les'tun Unit. In the fall of 2012, Refuge staff began coordinating with Coos County Public Health concerning the complaints of increased mosquito numbers and learned that Coos County does not have a Mosquito Abatement District. Mosquito Abatement Districts, also known as Vector Control Associations, are the

public entities that conduct mosquito monitoring, surveillance, and control activities across the country on public and private lands, including on National Wildlife Refuges where Special Use Permits have been issued for these activities. Refuge staff began detailing funding needs for Service-led inventory and monitoring of mosquitoes.

During the winter of 2012-2013 Refuge staff began discussions of mosquito inventory and monitoring needs on the Refuge with the Oregon Mosquito and Vector Control Association and Private Vector Control Managers. Discussions continued with Coos County Public Health concerning inventory and monitoring needs on Refuge lands. In the spring of 2013, Refuge staff coordinated with Center for Disease Control, Oregon State Health Department, U.S. Geological Survey, and Mosquito Research organizations but failed to locate additional funding for inventory and monitoring of mosquitoes. The Service established a cooperative agreement with Oregon State University's Entomology and Zoology Department to begin inventory and monitoring of mosquitoes on the refuge.

Beginning in June 2013, the local mosquito population grew tremendously, reaching levels unprecedented in recent decades according to local residents. On June 27-28, 2013 the Service and Oregon State University (OSU) began cooperative biweekly monitoring of mosquito larvae and adult abundance and species identification on the Refuge. This was coordinated with Multnomah and Benton County Public Health/Vector Control programs due to the lack of a Mosquito Abatement/ Vector Control District in Coos County. The mosquito species identified by the Multnomah District and Refuge staff for monitoring and control at the Refuge are *Aedes dorsalis*, *Aedes sticticus*, *Aedes cinereus*, *Culiseta particeps*, and *Culex tarsalis*. Although initial sampling found five species of mosquitoes present, about 90% of the mosquitoes sampled on the Refuge were identified as the salt marsh mosquito (*Aedes dorsalis*). Shallow impounded pools or depressions of water, which developed within the marsh after the highest tides of each month, were found to be providing breeding habitat for salt marsh mosquitoes at extremely high levels. Late July mosquito sampling following the recent monthly high tide series found larvae in great abundance (over 20 larvae per dip sample on average) in nearly every impounded water body on the Ni-les'tun Unit south of North Bank Lane. The larvae sampling at this time indicated that another major fly-off of salt marsh mosquitoes was imminent. In addition, adult trapping data indicated large numbers of adult females were using the restored tidal marsh as a breeding site and dispersing to adjacent habitats on the refuge and nearby private lands.

Beginning in June and continuing through August the USFWS offices at Bandon, Newport, and Portland received numerous complaints via phone calls, emails, and in-person visits from local citizens. Most of the complaints came from within a 2 km radius of the Refuge but some were more distant from the Refuge. Residents complained of not being able to go outside for most of each month during this period without being overwhelmed by large numbers of aggressively biting mosquitoes. The Service also received reports of local residents, including children, as well as some domestic animals needing medical attention due to allergic reactions to numerous bites.

On August 19, 2013, the City of Bandon passed Resolution 13-21 demanding action for immediate and effective mosquito abatement to protect public health, safety, and welfare of residents and visitors to Bandon. On August 22, 2013, Coos County Public Health Director Nikki Zogg issued a Health Advisory (Appendix D) for excessive mosquito numbers making working or recreating outside difficult. On August 26, 2013, Oregon Coast National Wildlife Refuge Complex Project Leader Roy W. Lowe made an Emergency Declaration (Appendix E) due to the excessive production of mosquitoes on the Ni-les'tun Unit of the Refuge affecting the health and safety of local residents and visitors to the Bandon area. Following the declaration, a

Special Use Permit (Appendix F) was issued to the Coos County Public Health Department allowing the use of specific pesticides on the Refuge for mosquito control during the 2013 mosquito season. The Coos County Public Health Department released a Draft “Proposal for Mosquito Control on the Bandon Marsh Refuge and Surrounding Area” to inform the public on the proposal and obtain approval of the County Commissioners to implement the plan (Coos County Public Health 2013). Following a public meeting and in consultation with mosquito control experts, Coos County Public Health selected the larvicide (S)-methoprene (trade name MetaLarv S-PT) to apply to a designated area of the Ni-les’tun Unit tidal marsh to prevent larval mosquitoes present on the refuge from maturing into adults. (S)-methoprene interferes with the larval insect’s maturation stages, preventing the insect from transforming into the adult stage, thereby precluding additional flying and biting mosquitoes. The aerial application was conducted on September 12, 2013 over 292 acres at the rate of four pounds per acre.

This treatment was determined to be necessary to decelerate the growth of an unprecedented mosquito population on the refuge. In the fall, female mosquitoes produce overwintering (diapause) eggs that do not hatch immediately with flooding, but overwinter in wait for favorable conditions the following spring. The Service was concerned that the final egg deposition of mosquitoes this summer, if not immediately treated, would produce a much greater egg source in the spring and continue the cycle of increasing mosquito numbers. (S)-methoprene was chosen as the most effective immediate treatment available to decelerate this cycle. Active Service involvement in mosquito abatement at this time was required to address responsibilities commensurate with our alteration of the landscape and its amenable conditions for mosquito population growth.

## **II. Alternatives**

There are two alternatives (No Project and Project) for this Environmental Assessment that are presented herein.

**Alternative 1:** No Project. There would be no larvicide treatment of mosquito breeding habitat within the Ni-les’tun Unit of Bandon Marsh NWR during summer 2013.

**Alternative 2:** Project. A single application of (S)-methoprene or MetaLarv S-PT (larvicide) to salt marsh mosquito (*Aedes dorsalis*) breeding habitat within the Ni-les’tun Unit of Bandon Marsh National Wildlife Refuge. The following is a detailed description of this larvicide application.

On September 12, 2013 (1630-1830 hrs), a single-engine fixed wing aircraft (Cessna 188 – Reg. No. 21852) applied MetaLarv S-PT at approximately 4.0 lbs/acre with a Transland Dry spreader to 292 acres of the Ni-les’tun Unit of Bandon Marsh National Wildlife Refuge (Refuge). The application was conducted under a contract between Coos County Public Health and Vector Disease Control International (VDCI). The VDCI applicator and pilot was licensed (#AG-L1021269CPA) for aerial pesticide treatments in the State of Oregon. This treatment was a refuge use (as defined in 603 FW 2.6Q) allowed under a Special Use Permit issued to Coos County Public Health on August 26, 2013.

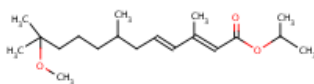
A total of 1,168 pounds (lbs) of MetaLarv S-PT was applied to the treatment area encompassing known salt marsh mosquito breeding habitat within the Ni-les’tun Unit (see Appendix A). Winds were calm with air temperature and dew point of 69°F and 59°F, respectively, during the application. The treatment swaths were approximately 60 feet wide as calculated by the aircraft

flight speed of 105 mph and 60-foot release altitude for the application. An assessment of the on-the-ground deposition (i.e., application rate) was conducted by Service personnel within the treatment area; the median application rate was 3.23 lbs/acre, where 50% of the sampled area received between 2.42 and 4.84 lbs/acre (U.S. Fish and Wildlife Service, unpublished data). The desired application rate to control salt marsh mosquitoes was achieved given the 25th to 75th percentile interval from treatment-deposition monitoring contained 4.0 lbs/acre.

Appendix A shows aerial tracking of the September 12 larvicide treatment area on the Ni-les'tun Unit. The onboard computer tracked where the plane was in real time using GPS, and automatically activated the sprayer as the plane was within the pre-programmed spray area. Green indicates where the sprayer was depositing MetaLarv S-PT, and red indicates the plane's track during turns outside of the spray area, with the sprayer off.

MetaLarv S-PT is a US EPA labeled pesticide (Reg. No. 73049-475), which is manufactured by Valent BioSciences Corporation. The MetaLarv S-PT formulation is granular-sized pellets (1-2 mm) that slowly release (S)-methoprene (active ingredient [ai]) up to 42 days for controlling emergence of adult floodwater (including *Aedes spp.*) and standing water mosquitoes. In accordance with the product label, MetaLarv S-PT can be applied to floodwater sites (including salt and tidal marshes) at 2.5-5.0 lbs/acre. It can be applied to mosquito breeding habitat at any time during the mosquito season.

(S)-methoprene is a racemic mixture of two enantiomers (R and S in a ratio of 1:1). Its activity as a juvenile hormone is restricted to the S enantiomer. (S)-methoprene is the common name for isopropyl-(2*E*,4*E*,7*R*,*S*)-11-methoxy-3,7,11-trimethyldodeca-2,4-dienoate. Its CAS number is 40596-69-8. Molecular and structural formulae for methoprene are C<sub>19</sub>H<sub>43</sub>O<sub>3</sub>.



(S)-methoprene mimics an insect growth regulation (IGR) hormone, where its insecticidal activity is based upon interfering with the normal maturation process. In a normal life cycle, an invertebrate goes from egg to larva to pupa and then to adult. (S)-methoprene inhibits the development by preventing maturation to the adult reproductive stage.

To be effective, it is essential to administer this IGR at the proper stage of the target pest's life cycle. (S)-methoprene only affects mosquito larvae, so it will not control pupal or adult stages. Treated larvae will pupate, but adults do not develop from the pupal stage. Generally, the last larval instar is most susceptible to (S)-methoprene (Staal 1975). It is effective at controlling a range of invertebrate pests from the following Arthropod orders: Diptera, Lepidoptera, and Coleoptera (Stark 2005).

### III. Affected Environment

The MetaLarv S-PT application was restricted to the tidal salt marsh (including some adjacent fresh marsh) section of the Ni-les'tun Unit (Appendix A). Therefore, the Affected Environment includes tidal wetland species that were present and potentially exposed during the time the (S)-methoprene was expected to be active, i.e., September 12 through approximately the end of October, 2013 (42 days). Due to the relative immobility of (S)-methoprene described in Section IV, exposure to the downstream estuary and marine environments is considered insignificant. The exposure period is defined as the time from the treatment date (September 12) through late October for an estimated 30-45 day exposure period, based upon the slow-release of (S)-methoprene with residual activity for approximately 42 days provided by MetaLarv S-PT pellets.

#### *Site Description*

In 2011, the Ni-les'tun Unit was restored, allowing the natural processes of tidal flow and sediment deposition to return to the former diked pastures where tidal flows had been blocked for nearly 100 years. The goal of this large-scale (over 400 acres) restoration effort was to restore natural processes (tidal exchange, salinity, natural temperature regimes), which in turn create the desired terrestrial and aquatic habitats, allowing native fish, wildlife, plant, and invertebrate species to return to the site. The restoration project involved restoring and creating over five miles of meandering tidal channels and filling nearly 15 miles of drainage ditches. The project also removed nearly two miles of dikes and three tidegates that had blocked the tides from entering the historic wetlands and two freshwater salmonid-bearing streams. The creation of sinuous tidal channels and re-meandering of straight-line ditched tributary creeks is now allowing unimpaired exchange of water and sediment between the project area and the Coquille River.

The estuarine salt marsh and tidal flats of the Ni-les'tun Unit contain rich beds of algae, marine invertebrates, and plant life that supports wading birds, migratory waterfowl, and shorebirds, which in turn provide an important prey base for numerous raptors including the recently delisted bald eagle and peregrine falcon (USFWS unpublished data). In addition, the sinuous tidal channels and mudflats, twice flooded by daily tides, provide essential habitat for numerous marine species of fish including starry flounder, surf smelt, and shiner perch, as well as important nursery habitat for anadromous species such as Chinook and coho salmon, steelhead, and coastal cutthroat trout (USFWS and FHA 2009).

Specific ecological parameters that have been monitored include plant communities (Brophy 2005), salmonid populations and behavior (Hudson et al. 2010, Brophy and Van de Wetering 2012), avian populations and habitat use (USFWS unpublished data), macro invertebrates (Van de Wetering unpublished data), and nutrient transport, site productivity and water quality (EPA unpublished data,). Information about the habitats and species potentially affected by the larvicide treatment presented in the remainder of this section is derived from the relevant monitoring efforts plus anecdotal observations of wildlife usage patterns.

#### *Water quality*

The water quality of the Ni-les'tun Unit is determined by the combination of fresh and marine sources of water for the marsh. We have no water quality data from either of these sources covering the time of the treatment, except water temperature and salinity measurements taken by automated data loggers that were deployed February 2013 and removed September 24, 2013. These data have not yet been analyzed and only pertain to flowing water in channels or soil water, and not to ponds on the marsh table. In general, surface pools are warmer than soil or channel water, and salinities range from near fresh to hypersaline, depending on position on the landscape and frequency of mixing with tide water and rainfall. Ranges of concentrations of pollutants such



as nutrients, suspended solids, coliform bacteria, pesticides, or heavy metals have not been measured within the marsh, and are therefore unknown.

#### *Sediment quality*

Before the restoration of the Ni-les'tun Unit, historical wetland soils had been subjected to drying and compaction due to the dikes, ditches, and livestock (Brophy and van de Wetering 2012). During the restoration construction, soils on portions of the site were further disturbed by heavy equipment traffic and earth moving operations including digging, scraping, and filling. Since August 2011, the return of the tides has begun the process of soil recovery to typical conditions of high organic content, saturation, raised salinity, and anoxia. The creation of sinuous tidal channels, dike removal, and re-meandering of straight-line ditched tributary creeks is now allowing unimpaired exchange of sediment between the project area and the Coquille River. All of these factors promote the formation of productive wetlands and mudflats for fish and wildlife.

#### *Migratory birds*

Bird use of the Ni-les'tun Unit has been monitored on a regular basis along an established sampling transect from November 2009 until late August 2013. Based on systematic observations made during the September-October periods of 2010 through 2012, Table 1 lists the species of birds potentially present in the treatment area during the treatment and exposed to the (S)-methoprene. Species listed as likely have been directly observed during this season in recent years. Those listed as unlikely could be present but are rarely seen in this season. The majority of the birds present at these times are transitory migrants, such as shorebirds and some waterfowl, and winter residents that are arriving, such as other waterfowl, raptors, waders, and passerines.

Table 1. Birds potentially exposed to the (S)-methoprene application and its active period (September 12 through October 2012).

<i>Common Name</i>	<i>Latin Name</i>	Likely	Unlikely
<i>Western Gull</i>	<i>Larus occidentalis</i>	X	
<i>California Gull</i>	<i>Larus californicus</i>	X	
<i>Caspian Tern</i>	<i>Sterna caspia</i>	X	
<i>Double-crested Cormorant</i>	<i>Phalacrocorax auritus</i>	X	
<i>Hooded Merganser</i>	<i>Lophodytes cucullatus</i>	X	
<i>Mallard</i>	<i>Anas platyrhynchos</i>	X	
<i>American Wigeon</i>	<i>Anas americana</i>	X	
<i>Green-winged Teal</i>	<i>Anas crecca</i>	X	
<i>Northern Pintail</i>	<i>Anas acuta</i>	X	
<i>Wood Duck</i>	<i>Aix sponsa</i>	X	
<i>Scaup sp.</i>	<i>Aythya sp.</i>		X
<i>Greater White-fronted Goose</i>	<i>Anser albifrons</i>		X
<i>Western Canada Goose</i>	<i>Branta canadensis</i>	X	
<i>Aleutian Cackling Goose</i>	<i>Branta minima</i>	X	
<i>Great Blue Heron</i>	<i>Ardea herodias</i>	X	
<i>Great Egret</i>	<i>Ardea alba</i>	X	
<i>Virginia Rail</i>	<i>Rallus limicola</i>	X	
<i>Wilson's Snipe</i>	<i>Gallinago delicata</i>	X	
<i>Short-billed Dowitcher</i>	<i>Limnodromus griseus</i>		X

<i>Long-billed Dowitcher</i>	<i>Limnodromus scolopaceus</i>	X	
<i>Least Sandpiper</i>	<i>Calidris minutilla</i>	X	
<i>Western Sandpiper</i>	<i>Calidris mauri</i>	X	
<i>Greater Yellowlegs</i>	<i>Tringa melanoleuca</i>	X	
<i>Solitary Sandpiper</i>	<i>Tringa solitaria</i>	X	
<i>Gadwall</i>	<i>Anas strepera</i>		X
<i>American Coot</i>	<i>Fulica Americana</i>		X
<i>Pectoral Sandpiper</i>	<i>Calidris melanotos</i>		X
<i>Dunlin</i>	<i>Calidris alpina</i>	X	
<i>Lesser Yellowlegs</i>	<i>Tringa flavipes</i>	X	
<i>Spotted Sandpiper</i>	<i>Actitis macularia</i>	X	
<i>Black-bellied Plover</i>	<i>Pluvialis squatarola</i>	X	
<i>Killdeer</i>	<i>Charadrius vociferus</i>	X	
<i>Semipalmated Plover</i>	<i>Charadrius semipalmatus</i>	X	
<i>Turkey Vulture</i>	<i>Cathartes aura</i>	X	
<i>White-tailed Kite</i>	<i>Elanus leucurus</i>	X	
<i>Northern Harrier</i>	<i>Circus cyaneus</i>	X	
<i>Red-tailed Hawk</i>	<i>Buteo jamaicensis</i>	X	
<i>Red-shouldered Hawk</i>	<i>Buteo lineatus</i>	X	
<i>Coopers Hawk</i>	<i>Accipiter cooperii</i>		X
<i>Sharp-shinned Hawk</i>	<i>Accipiter striatus</i>		X
<i>Bald Eagle</i>	<i>Haliaeetus leucocephalus</i>	X	
<i>Peregrine Falcon</i>	<i>Falco peregrinus</i>	X	
<i>Merlin</i>	<i>Falco columbarius</i>		X
<i>American Kestrel</i>	<i>Falco sparverius</i>	X	
<i>Short-eared Owl</i>	<i>Asio flammeus</i>		X
<i>Belted Kingfisher</i>	<i>Ceryle alcyon</i>	X	
<i>Northern Flicker</i>	<i>Colaptes auratus</i>	X	
<i>Black Phoebe</i>	<i>Sayornis nigricans</i>	X	
<i>Common Raven</i>	<i>Corvus corax</i>	X	
<i>American Crow</i>	<i>Corvus brachyrhynchos</i>	X	
<i>European Starling</i>	<i>Sturnus vulgaris</i>		X
<i>Red-winged Blackbird</i>	<i>Agelaius phoeniceus</i>		X
<i>Western Meadowlark</i>	<i>Sturnella neglecta</i>	X	
<i>Brewer's Blackbird</i>	<i>Euphagus cyanocephalus</i>	X	
<i>American Goldfinch</i>	<i>Carduelis tristis</i>	X	
<i>Lapland Longspur</i>	<i>Calcarius lapponicus</i>		X
<i>Savannah Sparrow</i>	<i>Passerculus sandwichensis</i>	X	
<i>White-crowned Sparrow</i>	<i>Zonotrichia leucophrys</i>	X	
<i>Song Sparrow</i>	<i>Melospiza melodia</i>	X	
<i>Lincoln's Sparrow</i>	<i>Melospiza lincolnii</i>	X	
<i>Purple Martin</i>	<i>Progne subis</i>		X
<i>Cliff Swallow</i>	<i>Petrochelidon pyrrhonota</i>	X	

<i>Barn Swallow</i>	<i>Hirundo rustica</i>	X	
<i>Tree Swallow</i>	<i>Tachycineta bicolor</i>	X	
<i>Violet-green Swallow</i>	<i>Tachycineta thalassina</i>	X	
<i>Common Yellowthroat</i>	<i>Geothlypis trichas</i>	X	
<i>American Pipit</i>	<i>Anthus rubescens</i>	X	
<i>Marsh Wren</i>	<i>Cistothorus palustris</i>	X	
<i>Black-capped Chickadee</i>	<i>Poecile atricapilla</i>		X
<i>American Robin</i>	<i>Turdus migratorius</i>		X

#### *Fish*

Fish use of waters within the Ni-les'tun Unit have been monitored via regular sampling throughout the year by USFWS staff and an independent contractor as part of the restoration efficacy monitoring program that ended in late September 2013 (Hudson et al. 2010, Van de Wetering unpublished data). This has included sampling along permanent streams flowing through the marsh, tidal channels, and the mainstem of the Coquille River. In general, these investigations show an increased use of the marsh channels by salmonids and estuarine species such as surf smelt, surf perch, and starry flounder. However, very low numbers of salmonids occur within the marsh during the treatment window due to seasonally warm temperatures. Table 2 lists all fish species known or likely to be present during the exposure period.

Table 2. Fish potentially exposed to the (S)-methoprene application and its active period (September 12 through October 2012).

Common Name	Latin Name	Likely	Unlikely
Northern Anchovy	<i>Engraulis mordax</i>		X
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	X	
Coastal cutthroat trout	<i>Oncorhynchus clarki</i>	X	
Coho salmon	<i>Oncorhynchus kisutch</i>		X
Steelhead trout	<i>Oncorhynchus mykiss</i>		X
Prickley Sculpin	<i>Cottus asper</i>	X	
Mosquito fish (non-native)	<i>Gambusia affinis</i>	X	
Brown bullhead (non-native)	<i>Ictalurus nebulosus</i>	X	
Black bullhead (non-native)	<i>Ictalurus melas</i>		X
Threespine stickleback	<i>Gasterosteus aculeatus</i>	X	
Largemouth bass (non-native)	<i>Micropterus salmoides</i>		X
Small mouth bass (non-native)	<i>Micropterus dolomieu</i>		X
Bluegill (non-native)	<i>Lepomis macrochirus</i>		X
Shiner surfperch	<i>Cymatogaster aggregate</i>	X	
Starry Flounder	<i>Platichthys stellatus</i>	X	
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>	X	
American Shad	<i>Alosa sapidissima</i>		X
Saddleback Gunnel	<i>Pholis ornata</i>		X
Surf Smelt	<i>Hypomesus pretiosus</i>		X
Eulachon	<i>Thaleichthys pacificus</i>		X

#### *Other estuarine invertebrates*

The fish monitoring program described above also incidentally sampled aquatic species such as shrimp, crab, and jellies. Based on those observations, species listed in Table 3 are known or likely to be present in the marsh during the exposure period. Some benthic invertebrates were also sampled directly, although not during the relevant season. Table 3 lists those taxa that may be present in September – October, as well as other taxa that have been opportunistically observed.

Table 3. Other estuarine invertebrates potentially exposed to the (S)-methoprene application and its active period (September 12 through October 2012).

Taxa	Common name
Caridea	grass shrimp
Brachyura	crab, dungeness crab
Cnidaria	jellies
Isopoda	isopod
Amphipoda	scuds
Gastropoda	snail
Nematode	round worms
Oligochaeta	marine worms
Veneroida	clams
Polychaeta	bristle worms
Insecta:	
Diptera	mosquito, midge, other flies
Hemiptera	water boatmen
Coleoptera	diving beetles
Odonata	damselflies and dragonflies
Megaloptera	fishflies

#### *Mammals*

No formal survey of mammal use of the Ni-les'tun Unit has been conducted, but species that have been observed using the marsh by Refuge personnel are listed in Table 4. Probably the most abundant and widespread mammal is Townsend's vole (*Microtus townsendii*), which uses the dense vegetation in the higher parts of the marsh. Raccoon (*Procyon lotor*) and mink (*Mustela vison*) are common medium-sized mammals based on the frequency with which their tracks are seen. Beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), and nutria (*Myocaster coypus*) are present but rarely observed, and probably occur in very low numbers, likewise for black-tailed deer (*Odocoileus hemionus columbianus*) and coyote (*Canis latrans*).

Table 4. Mammals potentially exposed to the (S)-methoprene application and its active period (September 12 through October 2012).

Common Name	Latin Name	Likely	Unlikely
Black-tailed Deer	<i>Odocoileus hemionus columbianus</i>	X	
Spotted Skunk	<i>Spilogale gracilis</i>		X
Striped Skunk	<i>Mephitis mephitis</i>		X
Short-tailed Weasel	<i>Mustela erminea</i>	X	

Mink	<i>Mustela vison</i>	X	
River Otter	<i>Lontra Canadensis</i>		X
Raccoon	<i>Procyon lotor</i>	X	
Coyote	<i>Canis latrans</i>	X	
Norway Rat	<i>Rattus norvegicus</i>		X
Black Rat	<i>Rattus rattus</i>		X
Townsend's Vole	<i>Microtus townsendii</i>	X	
Beaver	<i>Castor canadensis</i>	X	
Nutria	<i>Myocaster coypus</i>		X
Brush Rabbit	<i>Sylvilagus bachmani</i>		X
Townsend's Mole	<i>Scapanus townsendii</i>		X
Opossum	<i>Didelphis virginiana</i>		X
Common Muskrat	<i>Ondatra zibethicus</i>		X
Big Brown Bat	<i>Eptesicus fuscus</i>	X	
California myotis	<i>Myotis californicus</i>		X
Little Brown Bat	<i>Myotis lucifugus</i>	X	
Long-eared myotis	<i>Myotis evotis</i>		X
Yuma myotis	<i>Myotis yumanensis</i>		X
Silver-haired bat	<i>Lasionycteris noctivagans</i>		X

#### *Reptiles and amphibians*

The few representatives of these taxa are generally restricted to the northern fringes of the Ni-les'tun Unit, where fresh water dominates, and are listed in Table 5. No formal survey of these species has occurred during September – October at Ni-les'tun, so inclusion in the list is based on incidental observations.

Table 5. Reptiles and Amphibians potentially exposed to the (S)-methoprene application and its active period (September 12 through October 2012).

Common Name	Latin Name	Likely	Unlikely
Northwestern Salamander	<i>Ambystoma gracile</i>		X
Roughskin Newt	<i>Taricha granulose</i>	X	
Pacific Tree Frog	<i>Pseudacris regilla</i>	X	
Red-legged Frog	<i>Rana aurora</i>	X	
Bullfrog	<i>Rana catesbeiana</i>		X
Southern Alligator Lizard	<i>Elgaria multcarinata</i>		X
Northwestern Garter Snake	<i>Thamnophis ordinoides</i>		X

#### *Terrestrial invertebrates*

No formal survey of these taxa has occurred except for the mosquito monitoring, but there is undoubtedly a diverse community of terrestrial invertebrates using the dense vegetation and variety of microhabitats of the Ni-les'tun Unit.

Pre- and post- treatment mosquito surveys. Mosquito surveys were conducted to assess the abundance of larvae and pupae (immatures) populations. Larvae and pupae surveys occurred biweekly starting on July 11 through September 5, and on September 12 and 19. Larvae and

pupae were sampled at 37 to 41 pools along three transects established previously (Figure 2) for monitoring using the dip count method and their abundance was recorded on field data forms. The dip count method entails using a long- handled ladle (300 ml), called a dipper, to collect water and immature samples from possible mosquito sources. Each pool encountered was dipped at least three times and the number of immatures were counted in each dip and averaged. The mean count was categorized and recorded as zero (0), low (>0 to 20), medium (>20 – 100), or high (>100). The percentage of the total immatures that were larvae and pupae was also recorded. Additional notes about numbers of dead mosquitoes, algae cover of the pool, and presence of other aquatic invertebrates (dead or alive) were recorded. Pools that have held mosquitoes previously, but were dried up during the survey were recorded as such.



Figure 2. Larvae and pupae sampling transects at the Bandon Marsh National Wildlife Refuge, Ni-les'tun Unit. Colored dots represent 39 sampled breeding pool locations along the transects.  
*Results of immature mosquito surveys*

Table 6 summarizes the results of larval and pupae surveys to date, including surveys from August 8 onward to give context to the pre-treatment surveys. Note that the trend established fewer pools with medium or high abundance rankings and more pools with zero immatures as dates reach the treatment day. We attribute this trend to seasonal decline in the proportion of mosquito eggs hatching upon immersion consistent with increased proportion of diapause eggs being produced. The decline in adult mosquitoes was similarly dramatic (USFWS unpublished data) over the same time period, based on adult mosquito CO<sub>2</sub> trap surveys.

Although no formal counts were conducted, a general increase in non-mosquito aquatic invertebrates was noted as the season progressed, with some pools containing thousands of small to moderate sized hemipterans, dipterans, and coleopterans.

Table 6. Summary of results of larval surveys before and after the larvicide treatment on September 12.

Date of Survey	Known breeding pools on transects	Pools that were dry during survey	Sampled pools (contained water during survey)	Pools with zero larvae in 3 - 4 dips	Pools with average 1 - 20 larvae over 3 - 4 dips: Low	Pools with average 21 - 100 larvae over 3 - 4 dips: Medium	Pools with average >100 larvae over 3 - 4 dips: High
8/8/2013	37	11	26	0	13	6	7
8/21/2013	41	12	29	9	10	8	0
9/5/2013	42	14	28	10	14	4	0
9/12/2013	40	16	24	15	9	0	0
9/19/2013	39	16	23	17	5	1	0

### Larvicide Deposition Assessment

The larvicide deposition rate and uniformity must be documented to ensure the mosquito production areas are properly treated. Five areas within the Ni-les'tun Unit were identified as "mosquito production hot spots" based on density of breeding pools observed, and were designated as the focal monitoring sites (Figure 3). To determine larvicide deposition rate and uniformity, 30 shallow plastic containers (deposition trays) filled with 1-2 inches of filtered water were placed on the ground in openings in the vegetation the morning before treatment. Three deposition trays were placed in two locations within each of the five focal monitoring sites (Figure 3). The triplets of trays were arranged on the axes of an approximately two-meter equilateral triangle near a breeding pool, and each triplet was at least 50 meters apart within the focal area, and in places where the expected tides would not float the trays. GPS readings were taken and recorded at each deposition tray triplet placement site.

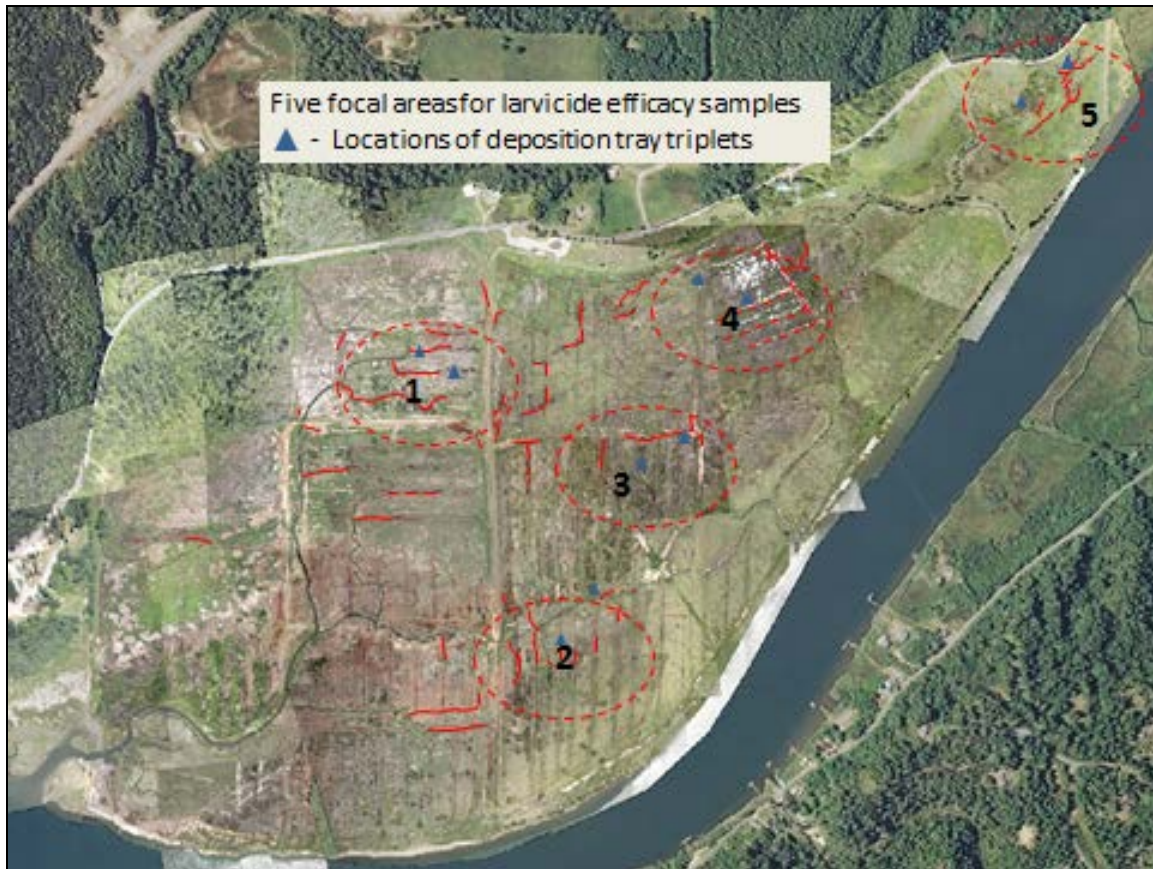


Figure 3. Five focal areas for larvicide efficacy samples. Focal monitoring sites and deposition tray triplets noted within the Ni-les'tun Unit of Bandon Marsh National Wildlife Refuge.

Pellets captured in the deposition trays were collected the morning after larvicide application.

Granule deposition or pellets were counted and the tray emptied. Each tray samples 157.5 square inches of area, and the total number of pellets captured in each triplet (472.5 square inches =  $7.5327 \times 10^{-5}$  acre) was extrapolated to estimate pellets per acre. Five samples of 50 of the MetaLarv S-PT pellets taken from the applicator supplies were weighed separately to estimate the average weight of 50 pellets. The following formula was used to calculate ounces of MetaLarv S-PT applied per acre:  $(\text{Number of pellets per triplet} \times 13275.42857) / 50 \times \text{Mean grams per 50 pellets}$ . Variance was estimated by the differences in the per acre estimate among the 10 triplets. The application rate was then translated into estimated environmental concentrations (EECs) of (S)-methoprene for deterministic risk assessment for screening level effects analyses. The median application rate was estimated to be 3.23 lbs/acre, with the 95% confidence interval of 2.42 to 4.84. Since the intended application rate of 4.0 lbs/acre falls within the confidence interval, the estimate is consistent with the intended rate.

### Larvicide Efficacy Monitoring

Assessment of efficacy for MetaLarv S-PT is based on adult mosquito emergence from pupae collected and held in the treated larval source (Valent BioSciences Corporation 2013). An attempt was made to sample pupae at the deposition tray sites, but the scarcity of pools with enough pupae to collect demanded collection at variable distances from tray sites. Sampling occurred four and fourteen days after treatment (9/16 and 9/26). At least 20 pupae were collected from each location on each sample day and held in water from the treated site during the



emergence process. BioQuip® Mini Mosquito Breeders (Figure 4) were used for easy monitoring of emergence. The pupae sample was placed in a separate cup inside the lower chamber of the breeder to prevent contact of treated water with the plastic surfaces of the breeder, which might get contaminated and affect future use. Adult mosquitos that emerged successfully and flew to the upper chamber were counted and compared to the total pupae in the sample to calculate the percent emergence inhibition resulting from the (S)-methoprene, using the formula:  
Percent Emergence Inhibition = 100 x (Pupae Collected – Live Adults)/ (Pupae Collected).  
Results of the larvicide efficacy tests are shown in Table 7 and indicate a high percent emergence inhibition, e.g. high larvicide efficacy.



Figure 4. BioQuip® emergence container (mini mosquito breeder).

Table 7. Results of the larvicide efficacy pupae samples collected on three dates post-treatment and held in mini breeders until all pupae died or transformed into adults.

Sample Date	Sample Location and Number	Number of Pupae Collected	Number of Adults in Upper Chamber	Percent Emergence Inhibition
9/16/2013	1	28	2	93
9/16/2013	2	21	12	43
9/16/2013	3	24	4	83
9/16/2013	4	21	3	86
9/16/2013	5	20	0	100
9/16/2013	6	22	0	100
9/16/2013	7	20	3	85
9/16/2013	8	20	5	75
9/16/2013	9	20	1	95
9/16/2013	Total	196	30	85
9/26/2013	1	20	0	100
9/26/2013	2	21	0	100
9/26/2013	Total	41	0	100
10/4/2013	1	20	0	100
10/4/2013	2	20	0	100
10/4/2013	3	20	0	100
10/4/2013	4	20	1	95
10/4/2013	Total	80	1	99

#### IV. Environmental Consequences

For comparison, the fate and effects of (S)-methoprene pertain only to Alternative 2 because there was no MetaLarv S-PT treatment for Alternative 1.

Unless specifically referenced, available environmental fate information presented herein was taken from the reregistration eligibility document for (S)-methoprene (US Environmental Protection Agency 1991).

**Fate of (S)-methoprene in water:** Sustained-release formulations such as MetaLarv S-PT discharge (S)-methoprene into water as pellets slowly dissolve over time. This is necessary to maintain a constant and effective level of (S)-methoprene in water to expose multiple generations of mosquito larvae given the pesticide dissipates rapidly in water. Short-term degradation in aquatic environments is caused by both microbial metabolism and photolysis. At normal temperatures and levels of sunlight, (S)-methoprene is rapidly degraded mainly by aquatic microorganisms and sunlight (Schooley et al. 1975). Concentrations of (S)-methoprene have been found to be reduced by >90% within 3 days after treatment for a variety of aquatic ecosystems. (S)-methoprene exhibited rapid degradation in both sterile and non-sterile pond water exposed to sunlight, where >80% degraded within 13 days. The --life values in pond water were 30 and 40 hours at initial (S)-methoprene concentrations of 0.001 and 0.01 ppm, respectively (Menize 1980). In addition, (S)-methoprene degradation occurs at the same rate in both freshwater and saltwater. That said, degradation proceeds faster at 20°C compared with 4.5°C, where measured half-lives were 10-35 days and >35 days, respectively.

After 3 days in pond water with an initial concentration of 0.42 ppm, three metabolites resulted from the degradation of (S)-methoprene: methoxycitronellic ester, hydroxycitronellic acid, and methoxycitronellic acid. After 13 days, the major degradate was methoxycitronellic acid (Menize 1980).

**Fate of (S)-methoprene in sediment and soil:** After (S)-methoprene is released into water, it is expected to rapidly and tightly adsorb to suspended solids in the water column and sediments based upon its  $K_{oc}$  value (23,000). The  $K_{oc}$  value also indicates (S)-methoprene is relatively immobile, where it would likely reside in the top few inches of soil or sediment. It is only slightly soluble in water with a water solubility ( $S_w$ ) value of 1.4 mg/L at 25C (Kidd and James 1991). These properties, along with its low environmental persistence, make it unlikely to be mobile in substrates. In field leaching studies, (S)-methoprene was observed only in the top few inches of the soil even after repeated washings with water (US Environmental Protection Agency 1982, Zoecon Corporation 1974b).

(S)-methoprene has low persistence in soils. (S)-methoprene rapidly metabolizes in soil and sediment under both aerobic and anaerobic conditions with a half-life of 10-14 days. When Altosid (a pesticide formulation with (S)-methoprene) was applied at 1 lb/acre, the (S)-methoprene half-life was <10 days (US Environmental Protection Agency 1982). Microbial degradation of (S)-methoprene occurs quickly in many soil types under a variety of environmental conditions. In soil, microbial degradation is rapid and appears to be the major route of its disappearance (US Environmental Protection Agency 1982, US Environmental Protection Agency 2001). (S)-methoprene also readily undergoes degradation by sunlight (US Environmental Protection Agency 2001). (S)-methoprene undergoes complete breakdown where the ultimate degradation product is CO<sub>2</sub>.

### Risk assessment to evaluate potential biotic effects

Risks from application of (S)-methoprene as a larvicide to control salt marsh mosquitoes within the Refuge's restored salt marsh can be objectively evaluated using the risk assessment framework established by US EPA (2004). Ecological risk can be quantified as a function of hazard and exposure. It uses a tiered system that transitions from deterministic models with conservative assumptions erring in favor of environmental safety to refined probabilistic models, where needed considering uncertainties of potential effects resulting from the deterministic phase.

It utilizes the following logical stepwise framework: problem formulation, hazard identification, dose-response relationships, exposure assessment, and risk characterization. These steps (below) allow for the comparison of an estimated environmental exposure with a reference dose associated with a toxic effect. This risk assessment focused only on (S)-methoprene because it undergoes complete breakdown after application, where major degradation products (e.g., methoxycitronellic acid) are less toxic than the parent pesticide. For example, the acute oral LD<sub>50</sub> for methoxycitronellic acid in rats is 5,763 to >10,000 mg/kg (Olson 1973).

#### *Problem formulation*

This deterministic risk assessment considered exposure and risk of aerially applied MetaLarv S-PT pellets containing (S)-methoprene to birds, mammals, fish, and estuarine organisms (invertebrates) that would potentially inhabit and utilize the treated mosquito breeding area within the restored salt marsh. The assessment was limited to the projected remainder of the mosquito season (mid-September to late October), which coincided with the residual activity of (S)-methoprene in controlling mosquito larvae. This assessment estimated risk to biotic taxa from exposure to (S)-methoprene dissolved in marsh waters with subsequent ingestion of water and food items that the pesticide may have settled on.

#### *Hazard identification*

The ecological risk assessment focused upon the mosquito larvicide, (S)-methoprene. No incident reports elsewhere within the U.S. have been recorded in conjunction with the use of (S)-methoprene for control of mosquitoes in salt marsh habitat.

(S)-methoprene is registered for application to salt and tidal marshes where slow-release formulations (e.g., MetaLarv S-PT pellets) can result in continuous water-borne exposure necessary to effectively control multiple generations of mosquito larvae. Because (S)-methoprene is an IGR, there is concern about potential effects to non-target estuarine invertebrates providing forage for a variety of wildlife, especially migratory birds and fish. Like other units of the National Wildlife Refuge System, the Refuge was established primarily for fish and wildlife. Moreover, there are few functional salt marshes remaining along with the West Coast so protection of its biological integrity is a resource management priority.

#### *Dose-relationships and toxic endpoints*

Unless specifically referenced, available effects information presented herein was taken from the reregistration eligibility document for (S)-methoprene (US Environmental Protection Agency 1991).

**Birds:** (S)-methoprene is characterized as practically non-toxic to slightly toxic to birds. For mallards, an acute LD<sub>50</sub> was >2,000 mg/kg (S)-methoprene (Zoecon Corporation 1974a). An 8-day dietary LC<sub>50</sub> for bobwhite quail was found to be >10,000 ppm methoprene. Moreover, (S)-methoprene had no effects on bobwhite quail reproduction at a dietary concentration of 30 ppm. For mallards, dietary concentrations of 30 ppm (S)-methoprene caused reproductive impairment, but 3 ppm had no effects. For chickens, an 8-day dietary LC<sub>50</sub> was >4,640 ppm (S)-methoprene (Kidd and James 1991, Zoecon Corporation 1974a).

Altosid ((S)-methoprene formulation) is characterized as slightly toxic to birds (Kidd and James 1991, Zoecon Corporation 1974a). The reported 5- to 8-day LC<sub>50</sub> values for Altosid are >10,000 ppm (S)-methoprene for mallards and bobwhite quail; the acute oral LD<sub>50</sub> for Altosid was >2,000 mg/kg (S)-methoprene for mallards (Zoecon Corporation 1974a). Nonlethal effects that may affect survival of mallards did appear at acute oral doses of 500 mg/kg (S)-methoprene (Zoecon Corporation 1974a); these effects (e.g., slowness, reluctance to move, sitting, withdrawal) appeared within 2 hours after treatment and persisted for up to 2 days (Hudson et al. 1984). These effects may decrease bird survival by temporarily increasing susceptibility to predation. No effects were observed for reproduction of bobwhite quail and mallards at 30 ppm (S)-methoprene based upon constant feeding of Altosid (Zoecon Corporation 1974a).

**Fish:** (S)-methoprene is characterized as slightly to moderately toxic to fish. The 96-hour LC<sub>50</sub> for bluegill sunfish was 1.52 ppm (S)-methoprene. The 96-hour LC<sub>50</sub> for rainbow trout was >50 ppm (S)-methoprene.

The 96-hour LC<sub>50</sub> values for (S)-methoprene (Altosid) were 4.6 mg/L for bluegill sunfish, 4.4 mg/L for rainbow trout, and >100 mg/L for channel catfish and largemouth bass (Kidd and James 1991, US National Library of Medicine 1995). Altosid had very little effect, if any, on exposed non-target aquatic organisms including mosquito fish (Zoecon Corporation 1974b). (S)-methoprene concentrations at 200 ppb did not affect locomotor activities of mosquito fish (Ellgaard et al. 1979). An early life stage test with newly spawned eggs for fathead minnows (*Pimephales promelas*) continuously exposed for 37 days to (S)-methoprene at concentrations ranging from 13 to 160 ppb found NOEC and LOEC (based upon reduction in body length and weight) values were 48 and 84 ppb, respectively; the estimated maximum acceptable toxicant concentration was 64 ppb methoprene (Ross et al. 1994).

(S)-methoprene has a minor potential to bioconcentrate in bluegill sunfish and crayfish (US Environmental Protection Agency 1982). Methoprene residues were found to accumulate in edible tissues of bluegill sunfish and crayfish at maximum BCFs of 457 and 75, respectively. Under laboratory conditions, the edible tissues of bluegill sunfish accumulated 550 to 950 times the ambient water concentrations of 5 ppb and 310 ppb (S)-methoprene, respectively. In contrast, non-edible tissues contained residue levels 12 times and 4 times greater than the edible portions associated with the low and high (S)-methoprene concentrations, respectively. After fish were removed from (S)-methoprene exposure, they excreted 93-95% of the residue (primarily as unmetabolized parent chemical) within 14 days.

**Estuarine organisms:** (S)-methoprene is characterized as slightly to very highly toxic (on an acute basis) to estuarine and marine invertebrates. (S)-methoprene was found to be slightly toxic to adult grass shrimp (*Palaemonetes pugio*) and very highly toxic to juvenile grass shrimp plus larval estuarine mud crabs. For adult grass shrimp, the 96-hour LC<sub>50</sub> was 1.0 ppm (S)-methoprene; a chronic reproductive test with this species showed no impacts with exposure to 1.0 ppm (S)-methoprene (Wirth et al. 2001). Verslycke et al. (2004) conducted 96-hr LC<sub>50</sub> tests with

the estuarine mysid shrimp (*Neomysis integer*) with a suite of chemicals (including (S)-methoprene); LC<sub>50</sub>s ranged from 0.32 to 1.95 ppm, where (S)-methoprene was noted to be on the lower end of this range. (S)-methoprene is very highly toxic to some species of freshwater, estuarine, and marine invertebrates, where the acute LC<sub>50</sub> values are >100 mg/L for freshwater shrimp and >0.1 mg/L for estuarine mud crabs (Zoecon Corporation 1974b). (S)-methoprene may inhibit gametogenesis in estuarine mud crabs exposed to 1.3 ppm for 12-15 days. Other studies (Gibson 2008, Dove et al. 2005, Butler 2005) determined that exposure of lobster (*Homarus americanus*) larvae to 0.05 ppb (S)-methoprene did not impact molting or survivability.

A small number of field studies indicate no effects of (S)-methoprene to non-target estuarine invertebrates in conjunction with mosquito control. Aerial application of Altosid ALL (pesticide formulation containing (S)-methoprene) to control mosquito larvae for a mangrove swamp in Florida did not affect sentinel non-target amphipods (Talitridae) or flying insects (Lawler et al. 1999). Similarly, no detectable effects (mortality) to non-target water boatman (*Trichocorixa reticulata*) or the abundance of other invertebrate species was found after treating salt marsh ponds with sustained-released (S)-methoprene (Altosid pellets) for mosquito control; (S)-methoprene continued to control mosquitoes through 99 days after treatment (Lawler and Jensen 2000).

Estuarine organisms are likely to be exposed in conjunction with the use of (S)-methoprene as a mosquito larvicide. In contrast, marine organisms would not likely to be exposed to (S)-methoprene; it has a short half-life in water with quick and tight binding to substrates making (S)-methoprene highly unlikely to be detected outside of salt and tidal marshes receiving treatments.

**Mammals:** (S)-methoprene is practically nontoxic to mammals. The acute oral LD<sub>50</sub>s of technical (S)-methoprene for rats and dogs are >10,000 mg/kg and 5,000 to 10,000 mg/kg, respectively. Other oral LD<sub>50</sub> values for (S)-methoprene in rats and dogs are >34,600 mg/kg and >5,000 mg/kg, respectively (Kidd and James 1991). An oral LD<sub>50</sub> for (S)-methoprene for rats was >5,000 mg/kg (Schindler and Brown 1984).

In a 2-year (chronic) feeding study, rats receiving 0 to 5,000 ppm methoprene (86% ai) in the diet had no toxic effects (e.g., body weight, behavior, food consumption, blood chemistry). In an 18-month feeding study with Charles River CD-1 mice receiving up to 2,500 ppm (S)-methoprene in the diet, there was systemic toxicity found at 2,500 ppm (pigmentation on livers), but no toxicological effects at 250 ppm; therefore, the NOEL (no observed effect level) for systemic toxicity was 250 ppm (S)-methoprene.

(S)-methoprene is not a developmental toxicant to mice based upon a NOEL for developmental effects at 600 mg/kg/day. For rabbits, (S)-methoprene doses as high as 2,000 mg/kg/day exhibited no developmental toxicity when administered during gestation days 7-18. In a three-generation reproductive study with rats, the NOEL was determined to be 2,500 ppm (S)-methoprene.

Rats were given Altosid in their diet for 6 months at (S)-methoprene dosage levels of 80 to 10,000 ppm; no toxic effects were noted at 400 ppm in the diet (Nagano et al 1977). A 90-day study with rats dosed with 0 to 5,000 ppm (S)-methoprene found 500 ppm was the NOEL for systemic toxicity (e.g., liver weights, kidney weights, renal tubular degradation) and 1,000 ppm was the lowest observed effect level (LOEL). A similar 90-day study with dogs established the NOEL and LOEL at 500 and 5,000 ppm (S)-methoprene, respectively.

**Terrestrial invertebrates:** (S)-methoprene is characterized as practically nontoxic to bees (Kidd and James 1991) given the LD<sub>50</sub> (oral and topical) for adult honeybees was >1000 µg/L/bee. Tests with earthworms found little, if any, toxic effects of (S)-methoprene on contact (Zoecon Corporation 1974b).

#### *Exposure assessment*

Refer to sections of the Affected Environment that describe utilization of the salt marsh by different species groups; it provides the justification and necessary context for the exposure scenarios presented below.

**Aquatic exposure:** For risk characterization, the following aquatic taxa would potentially be exposed to (S)-methoprene through dietary consumption and water ingestion after treatment of the salt marsh with MetaLarv S-PT: fish and estuarine invertebrates. S-methoprene concentrations in water are assumed to be constant over the 30-45 day exposure period (treatment day [Sept 12] to late October) based upon the following: MetaLarv S-PT pellets provide a slow-release of (S)-methoprene with residual activity for approximately 42 days, (S)-methoprene has a short half-life in water after release from pellets, and (S)-methoprene in the water column would quickly and tightly bind to the substrate after release in water considering its K<sub>oc</sub> and S<sub>w</sub> values.

**Terrestrial exposure:** For risk characterization, the following terrestrial taxa would potentially be exposed to (S)-methoprene through dietary consumption and incidental ingestion of water after treatment of the salt marsh with MetaLarv S-PT: birds and mammals. For deterministic risk analyses, birds and mammals are considered terrestrial even though their use of the salt marsh would mostly be considered aquatic in nature.

#### *Risk characterization*

US EPA deterministic risk assessment approach utilizes the quotient method to compare toxicity to environmental exposure (US Environmental Protection Agency 2004). In the deterministic approach, a RQ is calculated by dividing a point estimate of exposure by a point estimate of effects. This ratio is a simple, screening-level estimate that identifies potential high- or low-risk situations. Refer to the following US EPA website for more details on deterministic risk assessment: [http://www.epa.gov/oppefed1/ecorisk\\_ders/aquatic\\_life\\_benchmark.htm#ref\\_1](http://www.epa.gov/oppefed1/ecorisk_ders/aquatic_life_benchmark.htm#ref_1)

### **RQ = EXPOSURE / TOXICITY**

Calculation of RQs is based upon available ecological effects data, pesticide-use data, fate and transport data, and estimates of exposure to the pesticide. In this method, the estimated environmental concentration (EEC) is compared to an effect level (toxicological endpoint) such as an LC<sub>50</sub> (the lethal concentration of a pesticide where 50% of the organisms die in controlled laboratory study).

The Integrated Pest Management description (Appendix G) of the Refuge's final CCP ([http://www.fws.gov/oregoncoast/PDF/NES\\_SLZ\\_BDM\\_CCP/BandonMarshNWR.FinalCCP%20web.pdf](http://www.fws.gov/oregoncoast/PDF/NES_SLZ_BDM_CCP/BandonMarshNWR.FinalCCP%20web.pdf)) is incorporated by reference (40 CFR 1502.21 and 43 CFR 46.135). In particular, refer to the definition of terms within subsections G.7.7 (Toxicological Endpoints) and G.7.9 (Environmental Fate) as well as the assumptions of conducting ecological risk assessments within subsection G.7.2 (Determining Ecological Risk to Fish and Wildlife [page G-23 to G-29]). In

accordance with 43 CFR 46.120(d), use of an existing NEPA document through incorporating by reference would avoid redundancy and unnecessary paperwork.

To evaluate effects to aquatic taxa (fish and invertebrates) associated with the application of MetaLarv S-PT to the restored salt marsh on the Ni-les'tun Unit, the water-borne EEC of (S)-methoprene was estimated to be 62.5 ppb within the treatment area. This EEC was derived from following two-step process:

- 1) Convert the MetaLarv S-PT application rate to an ai-based ((S)-methoprene) rate:

$$(4.0 \text{ lbs MetaLarv S-PT/acre}) \times (0.0425 \text{ lbs s-methoprene/lb MetaLarv S-PT}) = 0.17 \text{ lbs s-methoprene/acre}$$

- 2) Use the maximum, expected pesticide concentration in a water body (12-inch water depth) immediately after direct application of 0.10 lbs ai/acre (see Table 2 in Urban and Cook 1986) and the (S)-methoprene application rate (Step 1) to calculate a water-borne EEC value:

$$(0.10 \text{ lbs pesticide ai/acre}) \times (36.7 \text{ ppb})^{-1} = (0.17 \text{ lbs s-methoprene/acre}) \times (\text{EEC})^{-1}$$

$$\text{EEC} = 62.5 \text{ ppb s-methoprene}$$

For birds and mammals (considered to be terrestrial taxa), T-REX (Terrestrial Residual Exposure) version 1.5.2 (<http://www.epa.gov/oppefed1/models/terrestrial/index.htm>) was used to calculate avian and mammalian risk quotients (RQs) using the LD<sub>50</sub>/ft<sup>2</sup> method given MetaLarv S-PT is a granular formation of (S)-methoprene. T-REX derives EECs in conjunction with calculation of the following RQs:

- Acute dietary RQ = (mg ai/ft<sup>2</sup>) / LD<sub>50</sub>
- Chronic dietary RQ = (mg ai/ft<sup>2</sup>) / NOAEL
- Acute dosed-based RQ = (ingestion rate-adjusted mg ai/ft<sup>2</sup>) / weight class-scaled LD<sub>50</sub>
- Chronic dosed-based RQ = (ingestion rate-adjusted mg ai/ft<sup>2</sup>) / weight class-scaled NOAEL

With this method, acute RQs are based on a toxicity (LD<sub>50</sub>) and exposure (mg ai/ft<sup>2</sup>) value. The dosed-based RQ incorporates the ingestion rate-adjusted exposure from the various food items for the different weight classes of birds and mammals and the weight class-scaled toxicity endpoints.

The calculated RQ(s) were then compared to US EPA established levels of concern (LOCs) to objectively evaluate potential risk to non-target taxa (US Environmental Protection Agency 1998). If a calculated RQ exceeds the corresponding LOC threshold, then there is potential risk (effects) to the taxa. Ecological LOCs for aquatic and terrestrial biota are provided in Appendix B.

The table below presents calculated RQs and US EPA LOCs for fish and invertebrate taxa in conjunction with the aquatic assessment for the MetaLarv S-PT application.

Aquatic Taxa	Acute Toxicity Endpoint (ppb)	RQ	LOC	Chronic Toxicity Endpoint (ppb)	RQ	LOC
Fish	760 <sup>1</sup>	0.08	0.5	48 <sup>2</sup>	1.30	<b>1.0</b>
Invertebrates	330 <sup>3</sup>	0.19	0.5	51 <sup>4</sup>	1.23	<b>1.0</b>

<sup>1</sup>Toxicity value is generally the lowest 96-hour LC<sub>50</sub> in a standardized test (usually with rainbow trout, fathead minnow, or bluegill).

<sup>2</sup>For chronic fish, toxicity value is usually the lowest NOEC from a life-cycle or early life stage test (usually with rainbow trout or fathead minnow).

<sup>3</sup>Toxicity value is the lowest 48- or 96-hour EC<sub>50</sub> or LC<sub>50</sub> in a standardized test (usually with midge, scud, or daphnids).

<sup>4</sup>Toxicity value is the lowest NOEC from a life-cycle test with invertebrates (usually with midge, scud, or daphnids).

Short-term adverse effects to fish and invertebrates from the MetaLarv S-PT application are not expected (Acute RQs < LOCs) in conjunction with a single application of (S)-methoprene to salt marsh habitat within the Ni'les'tun Unit. Although chronic RQs for fish and invertebrates exceeded respective LOC thresholds (bolded values in the table), this exposure scenario is not germane given there was only a single application and the short-term persistence (fate) for (S)-methoprene in aquatic environments. Moreover, there were tidal cycles that exchanged water within most of the salt marsh on a daily basis. The toxicity endpoint values used for RQ calculations are derived from laboratory tests where there is constant exposure of test organisms to the same water over the entire time of the testing procedures. Chronic values are presented for information purposes only recognizing that chronic RQs can be calculated for deterministic risk assessment.

Appendix C provides the output tables from T-REX 1.5.2 calculations of EECs and RQs for terrestrial assessments associated with birds and mammals. Because calculated RQs did not exceed LOCs, no effects to birds or mammals and minimal effects to other non-target species were expected in conjunction with the single application of MetaLarv S-PT to the salt marsh within the Ni'les'tun Unit.

## 5.0 Consultation and Coordination

The action which is the subject of this Environmental Assessment has been thoroughly vetted by the public, the media, Coos County, and Congressional representatives. Following the issuance of a Public Health Advisory by Coos County Public Health, Refuge and Service Regional Office staff discussed potential treatment prescriptions to control the mosquito source population for the remainder of the mosquito season. Participants in the discussion included managers and biologists from other National Wildlife Refuges, vector control biologists with Mosquito Abatement Districts (MAD) and Vector Control Districts (VCD), and technical representatives from mosquito treatment providers that are familiar with salt marsh mosquitoes. The option of pesticide treatment was first brought into the public debate at this time. Jackson County VCD was contacted by Coos County Public Health about the mosquito situation at Bandon Marsh because Coos County does not have Mosquito Abatement District or Vector Control District (VCD). Based upon a request from Coos County, Jackson County VCD provided a proposed mosquito control prescription for Bandon Marsh based upon limited information about the mosquito problem; the prescription involved both larvicide and adulticide treatments. The Coos County Public Health Department released a Draft "Proposal for Mosquito Control on the Bandon Marsh Refuge and Surrounding Area" to inform the public on the proposal and obtain approval of the County Commissioners to implement the plan. Coos County Commissioners and the City of Bandon considered the plan for approval. The County hosted a public meeting in Bandon to hear concerns of the citizens, and subsequently made the decision to use larvicide only on refuge lands. During all this time, Oregon Senators Ron Wyden and Jeff Merkley and



Representative Peter DeFazio were kept informed of the situation as it developed. The Service notified the National Marine Fisheries Service of the emergency action and is in the process of conducting Endangered Species Act consultation with the agency.

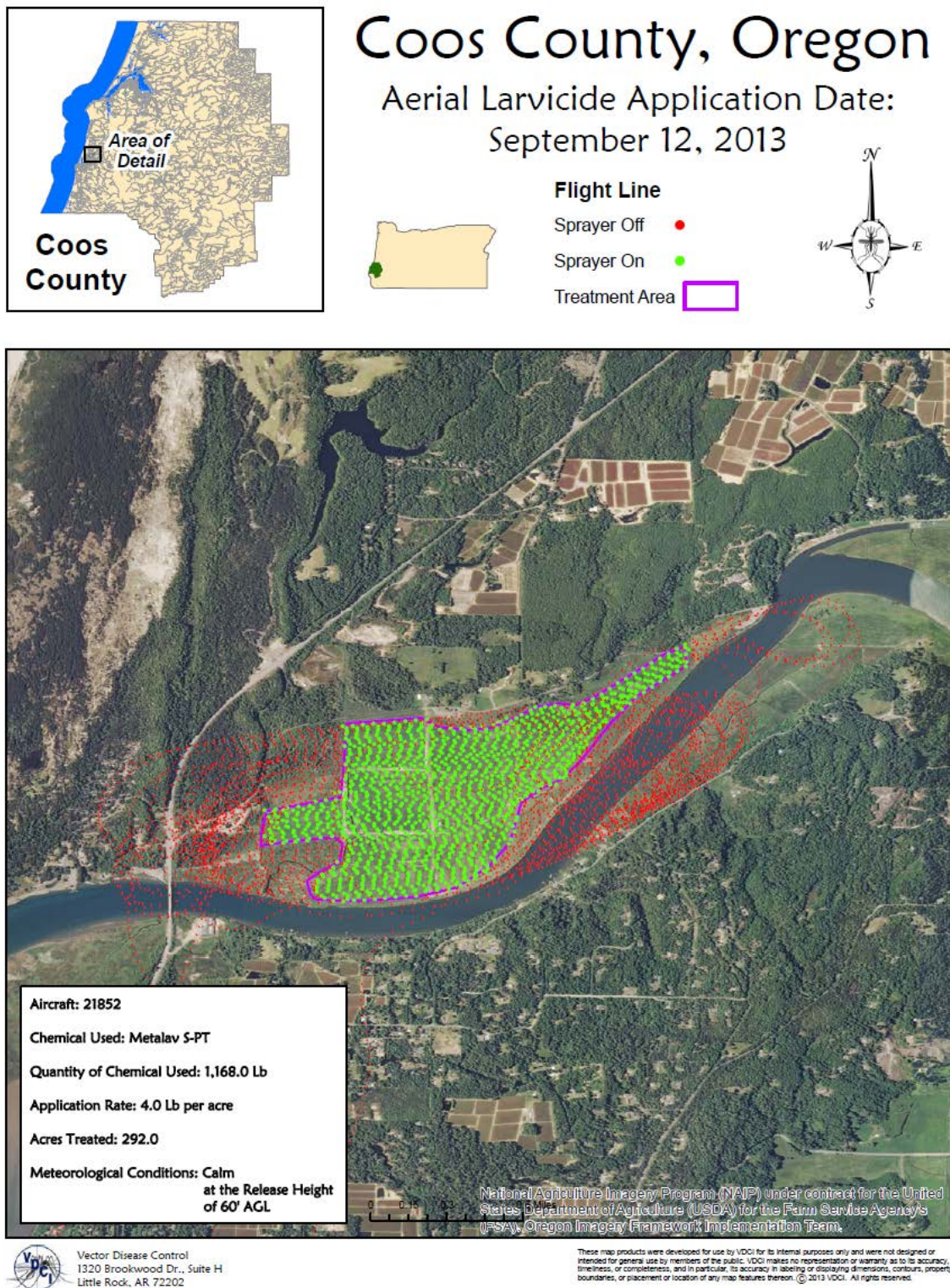
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Appendix A. Map depicting the MetaLarv S-PT treatment of the Ni-les'tun Unit of Bandon Marsh National Wildlife Refuge on September 12, 2013.



Appendix B. US Environmental Protection Agency established toxicity categories and Levels of Concern (LOCs; US Environmental Protection Agency 1998).

Categories of Toxicity for Aquatic Organisms LC <sub>50</sub> (ppm)	Toxicity Category
< 0.1	Very highly toxic
> 0.1 - 1	Highly toxic
> 1 - 10	Moderately toxic
> 10 - 100	Slightly toxic
> 100	Practically nontoxic

Categories of Toxicity for Terrestrial Organisms Oral dose LD <sub>50</sub> (mg/kg-bw)	Toxicity Category
< 10	Very highly toxic
10 - 50	Highly toxic
51 - 500	Moderately toxic
501 - 2000	Slightly toxic
> 2000	Practically nontoxic
Dietary LC <sub>50</sub> (ppm)	Toxicity Category
< 50	Very highly toxic
50 - 500	Highly toxic
501 - 1000	Moderately toxic
1001 - 5000	Slightly toxic
> 5000	Practically nontoxic
Categories of Bee Toxicity based upon Acute Contact LD <sub>50</sub> (µg/bee)	Toxicity Category
<2	Highly toxic
2 – 10.99	Moderately toxic
≥ 11	Practically nontoxic

***Risk Presumptions for Terrestrial Animals***

Risk Presumption	RQ	LOC
<b>Acute Risk</b>	EEC/LC <sub>50</sub> or LD <sub>50</sub> /ft <sup>2</sup> or LD <sub>50</sub> /day	0.5
<b>Acute Restricted Use</b>	EEC/LC <sub>50</sub> or LD <sub>50</sub> /ft <sup>2</sup> or LD <sub>50</sub> /day or LD <sub>50</sub> < 50 mg/kg	0.2
<b>Acute Endangered Species</b>	EEC/LC <sub>50</sub> or LD <sub>50</sub> /ft <sup>2</sup> or LD <sub>50</sub> /day	0.1
<b>Chronic Risk</b>	EEC/NOEC	1.0

***Risk Presumptions for Aquatic Animals***

Risk Presumption	RQ	LOC
<b>Acute High Risk</b>	EEC/LC <sub>50</sub> or EC <sub>50</sub>	0.5
<b>Acute Restricted Use</b>	EEC/LC <sub>50</sub> or EC <sub>50</sub>	0.1
<b>Acute Endangered Species</b>	EEC/LC <sub>50</sub> or EC <sub>50</sub>	0.05
<b>Chronic Risk</b>	EEC/NOAEC	1.0



Appendix C. Estimated environmental concentration (EEC)<sup>1</sup> and Risk quotient (RQ) calculations generated by T-REX version 1.5.2 for terrestrial taxa (birds and mammals) in conjunction with the application of MetaLarv to control larval mosquitoes at Bandon Marsh National Wildlife Refuge, September 2013. <sup>1</sup>All EECs used in RQ calculations were the upper bound of the Kenaga Nonogram.

Acute Avian Dose-Based RQs													
Size Class (grams)	Adjusted LD <sub>50</sub>	EECs and RQs											
		Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods		Granivore	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
20	1038.45	46.47	0.04	21.30	0.02	26.14	0.03	2.90	0.00	18.20	0.02	0.65	0.00
100	1322.00	26.50	0.02	12.14	0.01	14.90	0.01	1.66	0.00	10.38	0.01	0.37	0.00
1000	1867.37	11.86	0.01	5.44	0.00	6.67	0.00	0.74	0.00	4.65	0.00	0.16	0.00

Subacute Avian Dietary-Based RQs										
LC50	EECs and RQs									
	Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods	
	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
10000	40.80	0.00	18.70	0.00	22.95	0.00	2.55	0.00	15.98	0.00
Size class not used for dietary RQs.										

Chronic Avian Dietary-Based RQs										
NOAEC (ppm)	EECs and RQs									
	Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods	
	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
#####	40.80	#####	18.70	#####	22.95	#####	2.55	#####	15.98	#####

Because an avian NOAEC value could not be found, RQs were not calculated (#####).

Acute Mammalian Dose-Based RQs													
Size Class (grams)	Adjusted LD <sub>50</sub>	EECs and RQs											
		Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods		Granivore	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
15	21978.31	38.90	0.00	17.83	0.00	21.88	0.00	2.43	0.00	15.2357	0.0007	0.5403	<0.01
35	17782.79	26.88	0.00	12.32	0.00	15.12	0.00	1.68	0.00	10.5299	0.0006	0.3734	<0.01
1000	7691.61	6.23	0.00	2.86	0.00	3.51	0.00	0.39	0.00	2.4414	0.0003	0.0866	<0.01

Acute Mammalian Dietary-Based RQ										
LC <sub>50</sub> (ppm)	EECs and RQs									
	Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods	
	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
2000	40.80	0.02	18.70	0.01	22.95	0.01	2.55	0.00	15.98	0.01

Size class not used for dietary risk quotients

Chronic Mammalian Dietary-Based RQs										
NOAEC (ppm)	EECs and RQs									
	Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds/ Large Insects		Arthropods	
	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
50000	40.80	0.00	18.70	0.00	22.95	0.00	2.55	0.00	15.98	0.00

Size class not used for dietary risk quotients

Chronic Mammalian Dose-Based RQs													
Size Class (grams)	Adjusted NOAEL	EECs and RQs											
		Short Grass		Tall Grass		Broadleaf Plants		Fruits/Pods/Seeds		Arthropods		Granivore	
		EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ	EEC	RQ
15	5494.58	38.90	0.01	17.83	0.00	21.88	0.00	2.43	0.00	15.24	0.00	0.54	0.00
35	4445.70	26.88	0.01	12.32	0.00	15.12	0.00	1.68	0.00	10.53	0.00	0.37	0.00
1000	1922.90	6.23	0.00	2.86	0.00	3.51	0.00	0.39	0.00	2.44	0.00	0.09	0.00

Appendix D. Coos County Public Health Advisory



**COOS COUNTY *Public Health***

**Nikki Zogg, PhD, MPH**  
*Public Health Director*  
1975 McPherson #1  
North Bend, OR 97459  
Phone: 541-751-2425  
Fax: 541-751-2653  
Email: [nzogg@co.coos.or.us](mailto:nzogg@co.coos.or.us)



August 22, 2013

**FOR IMMEDIATE RELEASE**

## **Health Advisory**

Coos County is experiencing a greater than normal mosquito season. The heart of the problem is in and around the Bandon Marsh National Wildlife Refuge. Mosquitoes are in record number; mosquito collection and monitoring by Bandon Marsh National Wildlife Refuge have resulted in the trapping of hundreds to thousands of mosquitoes during trapping periods.

The primary species in the marsh, while not typically a vector of disease, is a day time biter. This can make working or recreating outdoors difficult. There have been five identified mosquito species at the marsh; some of them are known to transmit disease to animals or humans. The current risk for disease transmission due to a mosquito bite is low and there are no indicators to suggest that a mosquito-borne disease is currently circulating in any of the mosquito species in the marsh.

There have been no reported hospitalizations or deaths associated with mosquito bites.

To avoid mosquito bites:

- ☐ Use insect repellents when you go outdoors
- ☐ When weather permits, wear long sleeves, long pants, and socks when outdoors
- ☐ Take extra care during peak mosquito biting hours

Mosquito-proof your home:

- ☐ Install or repair screens on windows and doors to keep mosquitoes outside.
- ☐ Help reduce the number of mosquitoes around your home by emptying standing water from flowerpots, gutters, buckets, pool covers, pet water dishes, discarded tires, and birdbaths on a regular basis

If you have questions or concerns please contact Coos County Health Department at 541-751-2431.



Appendix E. Emergency Declaration



**United States Department of the Interior**

**FISH AND WILDLIFE SERVICE**  
Oregon Coast National Wildlife Refuge Complex  
2127 SE Marine Science Drive  
Newport, OR 97365-5258

**Memorandum**

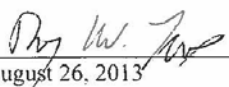
August 26, 2013

To: File

From: Project Leader, Oregon Coast NWRC  
Newport, Oregon

Subject: Emergency Declaration

Under the authority of the National Wildlife Refuge System Administration Act of 1966, as amended, I am hereby declaring an emergency exists on Bandon Marsh National Wildlife Refuge due to excessive production of mosquitoes on the Ni-les'tun Unit, which is affecting the health and safety of local residents and visitors in the Bandon area. This emergency declaration will allow actions to be taken immediately to abate the situation and protect health and safety of the public while a long-term IPM Plan is developed.

  
August 26, 2013

cc: Regional Chief, NWRS  
Refuge Supervisor

*The mission of the US Fish and Wildlife Service is working with others to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people.*

Appendix F. Special Use Permit

United States Department of the Interior  
U.S. Fish and Wildlife Service  
National Wildlife Refuge System  
General Special Use  
Application and Permit

OMB Control Number 1018-0102  
Expiration Date: 06/30/2014

**Application**

(To be filled out by applicant. Note: Not all information is required for each use.  
See instructions at the end of the notice.)

Name of Refuge Bandon Marsh NWR  
Address P.O. Box 99, Bandon, OR 97411  
Attn: (Refuge Official) Roy W. Lowe, Project Leader  
Phone # 5410-867-4550 E-mail Roy\_Lowe@fws.gov

1) ☒ New ☐ Renewal ☐ Modification ☐ Other \_\_\_\_\_

**Applicant Information**

2) Full Name: Dr. Nikki Zogg 6) Phone #: 541-751-2425  
3) Organization: Coos County Public Health 7) Fax #: 541-751-2659  
4) Address: 1975 McPherson #1 8) E-mail: nzogg@co.coos.or.us  
5) City/State/Zip: North Bend, OR 97459

9) Assistants/Subcontractors/Subpermittees: (List full names, addresses and phone #'s and specifically describe services provided if subcontractors are used.)

Jim Lunders  
Jackson County Vector Control District  
555 Mosquito Lane  
Central Point, OR 97502  
Ph 541-826-2199  
Fax 541- 826-8553

**Activity Information**

10) Activity type: ☐ Event ☐ Wood Cutting ☐ Group Visit ☐ Cabin/Subsistence Cabin ☐ Educational Activity  
☒ Other Application of pesticides for mosquito abatement

11) Describe Activity: (Specifically identify timing, frequency, and how the event is expected to proceed.)

Larval and adult mosquitoes may be treated with pesticides on Bandon Marsh NWR (Refuge). The objective of pesticide treatments is to control larval and adult mosquitoes in order to protect human and wildlife health and safety. Mosquito treatments are limited to the remainder of the 2013 mosquito season that is likely to be October 30th. Monitoring of larval and adult mosquito activity on the Refuge would indicate the duration of the mosquito season. The pesticides (active ingredients in trade name products) to control larval and adult mosquitoes permitted for use on the Refuge include the following: Bti, Bs, s-methoprene, pyrethrins/pyrethroids, and naled. Only pesticides with approved US EPA labels for use in the State of Oregon may be used on the Refuge. (see the full text of this box on the attached additional page)

12) Activity/site occupancy timeline: (Specifically identify beginning and ending dates, site occupation timeline, hours, clean-up and other major events.)

This SUP allows for one or more treatments as deemed necessary through the end of the 2013 mosquito breeding season.

(Depending on the activity for which you are requesting a permit, we may ask you for the following activity information.  
Please contact the specific refuge where the activity is being conducted to determine what activity information is required.)

13) Expected number of participants:

Children \_\_\_\_\_ Adults 1-2 Total 1-2

14) Grade level of educational group:

Grade \_\_\_\_\_ ☒ N/A

15) Will staff time/assistance be required?

☒ Yes ☐ No ☐ N/A

16a) Plan of Operation required? ☒ Yes ☐ No ☐ N/A

16b) Plan of Operation attached? ☐ Yes ☒ No

17) Location: (Specifically identify location; GPS location preferred.)

All wetland areas on Bandon Marsh NWR

18a) Is map of location(s) required?

☐ Yes ☒ No ☐ N/A

18b) Is map of location(s) attached?

☐ Yes ☒ No

### Insurance Coverage/Certifications/Permits

19a) Is insurance required?

☐ Yes ☐ No ☒ N/A

19b) Insurance: (Provided carrier, type and policy number)

20) Other licenses/certifications/permits required: (Specifically identify licenses, certifications, and permits.)

### Logistics and Transportation

21) Does activity require personnel to stay overnight onsite? ☐ Yes ☒ No

22) Personnel involved:

1 Pilot or 1 ground-based operator

23) Specifically describe all equipment/gear and materials used:

Aerial Application by fixed-wing and/or rotary-winged aircraft  
Ground application by Argo or other low-pressure tracked equipment.

24) Transportation description(s) and license number(s) to access refuge(s): (Provide description of and specific auto license/boat/plane registration number(s).)

Aircraft description and registration number(s) to be provided prior to flights

25) Specifically describe onsite work and/or living accommodations:

N/A

26) Specifically describe onsite hazardous material storage or other onsite material storage space:

N/A

27) Signature of Applicant



Date of Application: August 26, 2013

Sign, date, and print this form and return it to the refuge for processing.  
Do not fill out information below this page.

PRINT FORM

**For Official Use Only** (This section to be filled out by refuge personnel only.)

**Special Use Permit**

Permit #: BDM 034 0084

1) Date: August 26, 2013

2) ☒ Permit Approved ☐ Permit Denied

3) Station #: FF01RBDM00

4) Additional special conditions required: (Special conditions may include activity reports, before and after photographs, and other conditions.)

☐ Yes ☐ No ☐ N/A

Additional sheets attached:

☐ Yes ☐ No

5) Other licenses/permits required:

☐ Yes ☐ No ☒ N/A

Verification of other licenses/permits, type:

6) Insurance/certifications required:

☐ Yes ☐ No ☒ N/A

Verification of insurance/certification, type:

7) Record of Payments: ☒ Exempt ☐ Partial ☐ Full

Amount of payment: \$0

Record of partial payment: \_\_\_\_\_

8) Bond posted: ☐ Yes ☒ No

This permit is issued by the U.S. Fish and Wildlife Service and accepted by the applicant signed below, subject to the terms, covenants, obligations, and reservations, expressed or implied herein, and to the notice, conditions, and requirements included or attached. A copy of this permit should be kept on hand so that it may be shown at any time to any refuge staff.

Permit approved and issued by (Signature and title):

 Date: August 26, 2013

Permit accepted by (Signature of applicant):

 Date: August 26, 2013

#### Notice

In accordance with the Privacy Act (5 U.S.C. 552a) and the Paperwork Reduction Act (44 U.S.C. 3501), please note the following information:

1. The issuance of a permit and collection of fees on lands of the National Wildlife Refuge System are authorized by the National Wildlife Refuge System Administration Act (16 U.S.C. 668dd-ee) as amended, and the Refuge Recreation Act (16 U.S.C. 460k-460k-4).
2. The information that you provide is voluntary; however submission of requested information is required to evaluate the qualifications, determine eligibility, and document permit applicants under the above Acts. It is our policy not to use your name for any other purpose. The information is maintained in accordance with the Privacy Act. All information you provide will be considered in reviewing this application. False, fictitious, or fraudulent statements or representations made in the application may be grounds for revocation of the Special Use Permit and may be punishable by fine or imprisonment (18 U.S.C. 1001). Failure to provide all required information is sufficient cause for the U.S. Fish and Wildlife Service to deny a permit.
3. No Members of Congress or Resident Commissioner shall participate in any part of this contract or to any benefit that may arise from it, but this provision shall not pertain to this contract if made with a corporation for its general benefit.
4. The Permittee agrees to be bound by the equal opportunity "nondiscrimination in employment" clause of Executive Order 11246.
5. Routine use disclosures may also be made: (a) to the U.S. Department of Justice when related to litigation or anticipated litigation; (b) of information indicating a violation or potential violation of a statute, rule, order, or license to appropriate Federal, State, local or foreign agencies responsible for investigating or prosecuting the violation or for enforcing or implementing the statute, rule, regulations, order, or license; (c) from the record of the individual in response to an inquiry from a Congressional office made at the request of the individual (42 FR 19083; April 11, 1977); and (d) to provide addresses obtained from the Internal Revenue Service to debt collection agencies for purposes of locating a debtor to collect or compromise a Federal Claim against the debtor, or to consumer reporting agencies to prepare a commercial credit report for use by the Department (48 FR 54716; December 6, 1983).
6. An agency may not conduct or sponsor and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. This information collection has been approved by OMB and assigned control number 1018-0102. The public reporting burden for this information collection varies based on the specific refuge use being requested. The relevant public reporting burden for the General Use Special Use Permit Application form is estimated to average 30 minutes per response, including time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Comments on this form should be mailed to the Information Collection Clearance Officer, U.S. Fish and Wildlife Service, 4401 N. Fairfax Drive, MS 2042-PDM, Arlington, Virginia, 22203.

#### General Conditions and Requirements

1. Responsibility of Permittee: The permittee, by operating on the premises, shall be considered to have accepted these premises with all facilities, fixtures, or improvements in their existing condition as of the date of this permit. At the end of the period specified or upon earlier termination, the permittee shall give up the premises in as good order and condition as when received except for reasonable wear, tear, or damage occurring without fault or negligence. The permittee will fully repay the Service for any and all damage directly or indirectly resulting from negligence or failure on his/her part, and/or the part of anyone of his/her associates, to use reasonable care.
2. Operating Rules and Laws: The permittee shall keep the premises in a neat and orderly condition at all times, and shall comply with all municipal, county, and State laws applicable to the operations under the permit as well as all Federal laws, rules, and regulations governing national wildlife refuges and the area described in this permit. The permittee shall comply with all instructions applicable to this permit issued by the refuge official in charge. The permittee shall take all reasonable precautions to prevent the escape of fires and to suppress fires and shall render all reasonable assistance in the suppression of refuge fires.
3. Use Limitations: The permittee's use of the described premises is limited to the purposes herein specified and does not, unless provided for in this permit, allow him/her to restrict other authorized entry onto his/her area; and permits the Service to carry on whatever activities are necessary for: (1) protection and maintenance of the premises and adjacent lands administered by the Service; and (2) the management of wildlife and fish using the premises and other Service lands.
4. Transfer of Privileges: This permit is not transferable, and no privileges herein mentioned may be sublet or made available to any person or interest not mentioned in this permit. No interest hereunder may accrue through lien or be transferred to a third party without the approval of the Regional Director of the Service and the permit shall not be used for speculative purposes.
5. Compliance: The Service's failure to require strict compliance with any of this permit's terms, conditions, and requirements shall not constitute a waiver or be considered as a giving up of the Service's right to thereafter enforce any of the permit's terms or conditions.
6. Conditions of Permit not Fulfilled: If the permittee fails to fulfill any of the conditions and requirements set forth herein, all money paid under this permit shall be retained by the Government to be used to satisfy as much of the permittee's obligation as possible.
7. Payments: All payment shall be made on or before the due date to the local representative of the Service by a postal money order or check made payable to the U.S. Fish and Wildlife Service.
8. Termination Policy: At the termination of this permit the permittee shall immediately give up possession to the Service representative, reserving, however, the rights specified in paragraph 11. If he/she fails to do so, he/she will pay the government, as liquidated damages, an amount double the rate specified in this permit for the entire time possession is withheld. Upon yielding possession, the permittee will still be allowed to reenter as needed to remove his/her property as stated in paragraph 11. The acceptance of any fee for the liquidated damages or any other act of administration relating to the continued tenancy is not to be considered as an affirmation of the permittee's action nor shall it operate as a waiver of the Government's right to terminate or cancel the permit for the breach of any specified condition or requirement.
9. Revocation Policy: This permit may be revoked by the Regional Director of the Service without notice for noncompliance with the terms hereof or for violation of general and/or specific laws or regulations governing national wildlife refuges or for nonuse. It is at all times subject to discretionary revocation by the Director of the Service. Upon such revocation the Service, by and through any authorized representative, may take possession of the said premises for its own and sole use, and/or may enter and possess the premises as the agent of the permittee and for his/her account.

10. Damages: The United States shall not be responsible for any loss or damage to property including, but not limited to, growing crops, animals, and machinery or injury to the permittee or his/her relatives, or to the officers, agents, employees, or any other who are on the premises from instructions or by the sufferance of wildlife or employees or representatives of the Government carrying out their official responsibilities. The permittee agrees to save the United States or any of its agencies harmless from any and all claims for damages or losses that may arise to be incident to the flooding of the premises resulting from any associated Government river and harbor, flood control, reclamation, or Tennessee Valley Authority activity.

11. Removal of Permittee's Property: Upon the expiration or termination of this permit, if all rental charges and/or damage claims due to the Government have been paid, the permittee may, within a reasonable period as stated in the permit or as determined by the refuge official in charge, but not to exceed 60 days, remove all structures, machinery, and/or equipment, etc. from the premises for which he/she is responsible. Within this period the permittee must also remove any other of his/her property including his/her acknowledged share of products or crops grown, cut, harvested, stored, or stacked on the premises. Upon failure to remove any of the above items within the aforesaid period, they shall become the property of the United States.

#### Instructions for Completing Application

You may complete the application portion verbally, in person or electronically and submit to the refuge for review. Note: Please read instructions carefully as not all information is required for each activity. Contact the specific refuge headquarters office where the activity is going to be conducted if you have questions regarding the applicability of a particular item.

1. Identify if permit application is for new, renewal or modification of an existing permit. Permit renewals may not need all information requested. Contact the specific refuge headquarters office where the activity is going to be conducted if you have questions regarding the applicability of a particular item.

2-8. Provide full name, organization (if applicable), address, phone, fax, and e-mail.

9. Provide names and addresses of assistants, subcontractors or subpermittees. Names and address are only required if the assistants, subcontractors or subpermittees will be operating on the refuge without the permittee being present. Volunteers, assistants, subcontractors or subpermittees that are accompanied by the permittee need not be identified.

10. Activity type: check one of the following categories:

- a. Event;
- b. Wood cutting;
- c. Group visit;
- d. Cabin/Subsistence cabin;
- e. Educational activity; or
- f. Other---any other activity(s) not mentioned above. Please describe "other" activity.

11. Describe Activity: provide detailed information on the activity, including times, frequency and how the activity is expected to proceed, etc. Permit renewals may not need activity description, if the activity is unchanged from previous permit. Most repetitive activities, such as group visits, do not require an activity description for each visit. Contact the specific refuge headquarters office where the activity is going to be conducted to determine if an activity description is required.

12. Activity/site occupancy timeline: identify beginning and ending dates, site occupation timeline, hours, clean-up and other major events. Permit renewals may not need an activity/site occupancy timeline, if the activity is unchanged from previous permit. Most repetitive activities, such as group visits, do not require an activity/site occupancy timeline for each visit. Contact the specific refuge headquarters office where the activity is going to be conducted to determine if an activity/site occupancy timeline is required.

13-14 Expected number of participants: Provide an estimate of the number of adults, and children and grade level of group, if applicable.

15. Identify if onsite refuge staff will be required for group activities and anticipated time frame, if applicable.

16a-16b. Identify and attach Plan of Operation, if required. Most repetitive activities, such as group visits, do not require Plans of Operations for each visit. In addition, permit renewals may not require Plans of Operations if the activity is essentially unchanged from the previous permit. Contact the specific refuge headquarters office where the activity is going to be conducted to determine if a Plan of Operations is required.

17. Location: identify specific location (GPS coordinates preferred), if not a named facility. Most repetitive activities, such as group visits, do not require a location. In addition, permit renewals may not require a location if the activity is essentially unchanged from the previous permit. Contact the specific refuge headquarters office where the activity is going to be conducted to determine if a location is required.

18a-18b. Attach a map of location, if required and not conducted at a named facility. Most repetitive activities, such as group visits, do not require a map. In addition, permit renewals may not require a map if the activity is essentially unchanged from the previous permit. Contact the specific refuge headquarters office where the activity is going to be conducted to determine if a map is required.

19a-19b. Provide name, type and carrier of insurance, if required. Contact the specific refuge headquarters office where the activity is going to be conducted to determine if insurance and type of insurance are required.

20. Specifically identify types and numbers of other licenses, certifications or permits, if required. Contact the specific refuge headquarters office where the activity is going to be conducted to determine the types of licenses, certifications or permits required, and to coordinate the simultaneous application of several types of licenses, certifications or permits. This Special Use Permit (SUP) may be processed while other certifications are being obtained.

21-22. Provide name(s) of any personnel required to stay overnight, if applicable.

23. Identify all equipment and materials, which will be used, if required. Most repetitive events, such as group visits, do not require a list of equipment. In addition, permit renewals may not require a list of equipment if the event is essentially unchanged from the previous permit. Contact the specific refuge headquarters office where the activity is going to be conducted to determine if a list of equipment is required.

24. Describe and provide vehicle descriptions and license plate or identification numbers of all vehicles, including boats and airplanes, if required. Motor vehicle descriptions are only required for permittee vehicle, and/or if the vehicle will be operated on the refuge without the permittee being present. Motor vehicles that are accompanied by the permittee as part of a group (convoy) activity need not be identified if cleared in advance by refuge supervisor. Specifically describe ship-to-shore, intersite (between islands, camps, or other sites) and onsite transportation mechanisms, and license plate or identification numbers, if required.

25. Specifically describe onsite work and/or living accommodations, if applicable.

26. Specifically describe onsite hazardous material storage, or other onsite material storage space (including on and offsite fuel caches).

27. Sign, date, and print the application. Click on the Print button to print the application (if using the fillable version). The refuge official will review and, if approved, fill out the remaining information, sign, and return a copy to you for signature and acceptance.

**The form is not valid as a permit unless it includes refuge approval, a station number, a refuge-assigned permit number, and is signed by a refuge official.**



## United States Department of the Interior



### FISH AND WILDLIFE SERVICE

Oregon Coast National Wildlife Refuge Complex  
2127 SE Marine Science Drive  
Newport, OR 97365

#### **Full Text from Box 11.**

Larval and adult mosquitoes may be treated with pesticides only on Bandon Marsh NWR (Refuge). The objective of pesticide treatments is to control larval and adult mosquitoes in order to protect human and wildlife health and safety. Mosquito treatments are limited to the remainder of the 2013 mosquito season that is likely to be October 30<sup>th</sup>. Monitoring of larval and adult mosquito activity on the Refuge would indicate the duration of the mosquito season. The pesticides (active ingredients in trade name products) to control larval and adult mosquitoes permitted for use on the Refuge include the following: Bti, Bs, s-methoprene, pyrethrins/pyrethroids, and naled. Only pesticides with approved US EPA labels for use in the State of Oregon may be used on the Refuge. All pesticide label requirements (e.g., application equipment, maximum application rate) must be followed in accordance with the Federal Insecticide, Fungicide, and Rodenticide Act.

Larvicide treatments will only be permitted to occur within mosquito breeding habitat on the Refuge. The Refuge staff will delineate the area of mosquito breeding habitat considering on-going mosquito monitoring when larval treatment(s) are needed. Where feasible (primarily for ground-based treatment), the application of a mosquito adulticide will focus on areas of the Refuge harboring adult and/or maturing adult mosquitoes.

The Refuge Manager will be notified at least 24 hours in advance of any pesticide treatment for mosquitoes on the Refuge, where practicable. All applications of mosquito pesticides will be by pesticide applicators with a current license in the State of Oregon and have other necessary permits, as applicable.

#### **Special Conditions for Refuge Special Use Permit #BDM 034 0084 Coos County Health Department**

1. Permittee will attend a pre- and post-season coordination meeting with Refuge staff and will provide plan of operation prior to commencement of work.
2. Permittee agrees to minimize disturbance and impacts to wildlife, fish and habitats.
3. The permittee is responsible for ensuring that all persons working for the permittee and conducting activities allowed by this permit are familiar with and adhere to the conditions of this permit.
4. The U.S. Fish and Wildlife Service reserves the right to have employees / representatives present during all fieldwork.





5. Permittee will coordinate all pesticide application in advance (minimum 24 hours) with Refuge Manager Dave Ledig (541-347-1470) to ensure there is no conflict with Refuge management.
6. The permittee shall provide the Refuge with a report of activities under this permit by November 30<sup>th</sup>. This report shall include a map identifying all treated areas and records of application (dates, site treatment, name of pesticide applied, quantity applied (pounds)).
7. Permittee agrees to acknowledge Bandon Marsh NWR and the U.S. Fish and Wildlife Service in all written and oral presentations of data collected.
8. This permit may be cancelled or revised at any time by the Project Leader for noncompliance or in case of an emergency.

## **Finding of No Significant Impact**

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### **Environmental Assessment: MetaLarv S-PT Treatment on the Ni-les'tun Unit to Control Salt Marsh Mosquitoes**

#### **Introduction**

In 2011, the U. S. Fish and Wildlife Service (Service), a team of cooperators, and experts in the field of Oregon tidal marsh ecology and restoration completed a 420-acre tidal marsh restoration project on the Ni-les'tun Unit of Bandon Marsh National Wildlife Refuge (NWR or Refuge). During marsh restoration, depressions that impound tidal waters were inadvertently created where ditches were not adequately filled, where fill material settled, and where heavy equipment on the site left track marks. These depressions continue to strand shallow water as higher monthly tides recede and provide breeding sites for mosquitoes.

Beginning in June 2013, the local mosquito population grew tremendously, reaching levels unprecedented in recent decades according to local residents. Subsequent to the August 19, 2013 City of Bandon passing Resolution 13-21 demanding action for immediate and effective mosquito abatement to protect public health, safety, and welfare of residents and visitors to Bandon and the August 22, 2013 Coos County Public Health issuing a Health Advisory for excessive mosquito numbers making working or recreating outside difficult, on August 26, 2013 Oregon Coast National Wildlife Refuge Complex Project Leader Roy W. Lowe made an Emergency Declaration due to the excessive production of mosquitoes on the Ni-les'tun Unit of the Refuge affecting the health and safety of local residents and visitors to the Bandon area. Following the declaration, a Special Use Permit was issued to the Coos County Public Health Department allowing the use of specific pesticides on the Refuge for mosquito control during the 2013 mosquito season.

The Coos County Public Health Department released a Draft "Proposal for Mosquito Control on the Bandon Marsh Refuge and Surrounding Area" to inform the public on the proposal and obtain approval of the County Commissioners to implement the plan (Coos County Public Health 2013). Following a public meeting and in consultation with mosquito control experts, Coos County Public Health selected the larvicide (S)-methoprene (trade name MetaLarv S-PT) to apply to a designated area of the Ni-les'tun Unit tidal marsh to prevent larval mosquitoes present on the refuge from maturing into adults. (S)-methoprene interferes with the larval insect's maturation stages, preventing the insect from transforming into the adult stage, thereby precluding additional flying and biting mosquitoes. The aerial application was conducted on September 12, 2013 over 292 acres at the rate of four pounds per acre.

Due to the emergency situation and need to respond to Coos County Health Advisory, the Service did not satisfy the procedural requirements of the National Environmental policy Act prior to the September 12, 2013 application of MetaLarv S-PT. In November of 2013 the Service completed a post-emergency action Environmental Assessment and this Finding of No Significant Impact.

## Alternatives

Two alternatives (No Project and Project), summarized below, were evaluated in an Environmental Assessment.

**Alternative 1: No Project.** There would be no larvicide treatment of mosquito breeding habitat within the Ni-les'tun Unit of Bandon Marsh NWR during summer 2013.

**Alternative 2: Project.** A single application of (S)-methoprene or MetaLarv S-PT (larvicide) to salt marsh mosquito (*Aedes dorsalis*) breeding habitat within the Ni-les'tun Unit of Bandon Marsh National Wildlife Refuge.

A detailed description of this larvicide application and anticipated effects of the treatment are contained in the Environmental Assessment.

## Public Involvement

The single application action which is the subject of the Environmental Assessment was thoroughly vetted by the public, the media, Coos County, and Congressional representatives. Following the issuance of a Public Health Advisory by Coos County Public Health, Refuge and Service Regional Office staff discussed potential treatment prescriptions to control the mosquito source population for the remainder of the mosquito season. Participants in the discussion included managers and biologists from other National Wildlife Refuges, vector control biologists with Mosquito Abatement Districts (MAD) and Vector Control Districts (VCD), and technical representatives from mosquito treatment providers that are familiar with salt marsh mosquitoes. The option of pesticide treatment was first brought into the public debate at this time. Jackson County VCD was contacted by Coos County Public Health about the mosquito situation at Bandon Marsh because Coos County does not have Mosquito Abatement District or Vector Control District (VCD). Based upon a request from Coos County, Jackson County VCD provided a proposed mosquito control prescription for Bandon Marsh based upon limited information about the mosquito problem; the prescription involved both larvicide and adulticide treatments. The Coos County Public Health Department released a Draft "Proposal for Mosquito Control on the Bandon Marsh Refuge and Surrounding Area" to inform the public on the proposal and obtain approval of the County Commissioners to implement the plan. Coos County Commissioners and the City of Bandon considered the plan for approval. The County hosted a public meeting in Bandon to hear concerns of the citizens, and subsequently made the decision to use only larvicide on refuge lands. During all this time, Oregon Senators Ron Wyden and Jeff Merkley and Representative Peter DeFazio were kept informed of the situation as it developed.

## Rationale for Decision

This treatment was determined to be necessary for immediate implementation to decelerate the growth of an unprecedented mosquito population on the refuge. In the fall, female mosquitoes produce overwintering (diapause) eggs that do not hatch immediately with flooding, but overwinter in-wait for favorable conditions the following spring. The Service was concerned that the final egg deposition of mosquitoes this summer, if not immediately treated, would produce a much greater egg source in the spring and continue the cycle of increasing mosquito numbers. (S)-methoprene was chosen as the most effective immediate treatment available to decelerate this cycle. Active Service involvement in mosquito abatement at this time was required to address

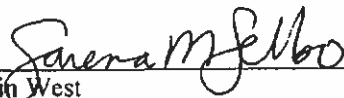
responsibilities commensurate with our alteration of the landscape and its amenable conditions for mosquito population growth.

### **Conclusion**

As described in detail in the Environmental Assessment, allowing the single application of (S)-methoprene on refuge lands to control mosquitoes is not expect to result in adverse effects to the natural and physical environment and the relationship of people with that environment.

Therefore, it is my determination that implementing the Preferred Alternative does not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969. Accordingly, the preparation of an EIS is not required.

The Environmental Assessment on which this Finding of no Significant Impact is based is available online at <http://www.fws.gov/oregoncoast/bandonmarsh/>. A copy of the EA may also be requested by contacting the Refuge Manager at 541-347-1470.

*Acting*   
Robin West  
Regional Chief, National Wildlife Refuge System

8 Nov 2013  
Date

### **References:**

U.S. Fish and Wildlife Service. 2013. Environmental Assessment, MetaLarv S-PT Treatment on the Ni-les'tun Unit to Control Salt Marsh Mosquitoes.

## Appendix H.

### Compatibility Determination

**Use:** Single application of larvicide ((S)-methoprene product) to Ni-les'tun Unit of Bandon Marsh NWR to reduce mosquito production

**Refuge Name:** Bandon Marsh National Wildlife Refuge

**County and State:** Coos County, Oregon

### Establishing and Acquisition Authorities:

Bandon Marsh National Wildlife Refuge (NWR) was authorized by Public Law 97-137, of December 29, 1981 and established by the authority of the Fish and Wildlife Act of 1956, as amended [16 U.S.C. 742a-742j] to protect migratory bird habitat. Additional lands were added to the Refuge in the 1990s through the Refuge Recreation Act of 1962, as amended [16 U.S.C. 460k-4]. Public Law 105-321 (95 Stat. 1709; Oregon Public Lands Transfer and Protection Act of 1998) amended P.L. 97-137 to authorize boundary expansion of Bandon Marsh NWR from 300 to 1,000 acres. Legal authorities used for establishment of the Refuge include the Endangered Species Act of 1973, as amended [16 U.S.C. 1531-1544] and the Migratory Bird Conservation Act of 1929, as amended [16 U.S.C. 715-715d, 715e, 715f-715r].

### Refuge Purpose(s):

- “For the preservation and enhancement of the highly significant wildlife habitat ... for the protection of migratory waterfowl, numerous species of shorebirds and fish ... and to provide opportunity for wildlife-oriented recreation and nature study on the marsh” [95 Stat. 1709, dated Dec. 29, 1981] and Public Law 97-137 – Dec. 29, 1981 and H.R. 2241 March 2, 1981.
- “for the development, advancement, management, conservation, and protection of fish and wildlife resources” [16 U.S.C. 742f(a)(4)]; “for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude” [16 U.S.C. 742f (b)(1) (Fish and Wildlife Act of 1956)].
- “particular value in carrying out the national migratory bird management program” [16 U.S.C. 667b (An Act Authorizing the Transfer of Certain Real Property for Wildlife)].

**National Wildlife Refuge System Mission:**

“The mission of the System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (National Wildlife Refuge System Administration Act of 1966 as amended, 16 U.S.C. 668dd-668ee).

**Description of Use:**

The use is a single application of a larvicide (MetaLarv S-PT) to identified mosquito breeding habitat within the Ni-les'tun Unit of Bandon Marsh NWR, completed under an emergency declaration.

MetaLarv (S-PT) is the trade name of a biorational pre-hatch insecticide manufactured by Valent BioSciences Corporation for control of mosquito larvae in floodwater areas. The active ingredient is (S)-methoprene. (S)-methoprene is a juvenile hormone analog of mosquitoes that prevents the emergence of adult mosquitoes. A single-engine fixed wing aircraft (Cessna 188) applied MetaLarv S-PT at 4.0 lbs/acre with a Transland Dry spreader to 292 acres of the Ni-les'tun Unit of Bandon Marsh National Wildlife Refuge (Refuge) during a 2-hour time period (1630-1830) on September 12, 2013.

Approximately 1,168 pounds (lbs) of MetaLarv S-PT was applied to the treatment area encompassing known salt marsh mosquito breeding habitat within the Ni-les'tun Unit (see Appendix A). Winds were calm with air temperature and dew point of 69F and 59F, respectively, during the application. The treatment swaths were 60 feet wide as calculated by the aircraft flight speed of 105 mph and 60-foot release altitude for the application.

(S)-methoprene was applied to the refuge tidal marsh to prevent larval mosquitoes currently present on the refuge from maturing into adults. (S)-methoprene interferes with the insect's maturation stages, preventing the insect from transforming from pupae into the adult stage, thereby precluding additional production of mosquitoes and subsequent reproduction. (S)-methoprene is a contact insecticide that does not need to be ingested. It is most effective on early larval instars but does not affect pupae or adult mosquitoes (Extension Toxicology Network, 1996). Treated larvae will pupate, but will not emerge as adults. The insect eventually dies in the pupal stage. In mosquito control applications, (S)-methoprene is applied directly to the larval breeding habitat.

This treatment was determined to be necessary to decelerate the growth of an unprecedented salt marsh mosquito population on the refuge. The refuge's tidal marsh restoration and land alteration actions on the

Ni-les'tun Unit of Bandon Marsh NWR during 2009-2011 is thought to be one of the contributing factors to the increased mosquito population in and around the refuge. The tidal marsh restoration project was completed in August 2011 by a team of cooperators and experts in the field of Oregon tidal marsh ecology and restoration. Without known or suspected concerns with mosquitoes in the past, mosquito control/management was not integrated into the tidal marsh restoration project on the Ni-les'tun Unit. No previous salt marsh restoration by the Refuge Complex or its many partners on the Oregon Coast over the past decades experienced this situation. The previous century of management as a diked pastureland had left this historic tidal marsh with approximately 15 miles of drainage ditches, which were largely filled in while new sinuous tidal channels were created during restoration. The resulting uneven areas of terrain, combined with the impact of heavy equipment needed for the project, left ruts and shallow areas that strand water as higher tides recede. These depressions fill with water during monthly high tide events and create breeding habitat for salt marsh mosquitoes.

In June of 2013 the Refuge began to inventory and monitor mosquitoes with the assistance of Oregon State University. Five species of mosquitoes were identified; however, the majority of the population (>90%) was identified as the salt marsh mosquito (*Aedes dorsalis*). The numerous shallow ponds that develop during the highest tides of the month provide breeding sites for salt marsh mosquitoes at extremely high levels. In addition, carbon dioxide adult trapping efforts found that large numbers of adult females were using the Ni-les'tun Unit of the Refuge and that they were dispersing to adjacent habitats on the refuge. The creation of additional breeding environments for mosquitoes on the refuge was an entirely unintended and unanticipated consequence of the tidal marsh restoration.

Active U. S. Fish and Wildlife Service (Service) involvement in mosquito abatement at this time was required to address responsibilities commensurate with our alteration of the landscape and its amenable conditions for mosquito population growth. Since June 2013, the salt marsh mosquito population in the Bandon area has grown at a high rate. If left untreated, each generation of *Aedes dorsalis* breeds and grows much larger than the previous, and this species is capable of producing up to eight generations per season. On the Ni-les'tun restoration area, monthly high tides reflood the shallow depressions/pools, with resulting major flyoff of adult mosquitoes 8-10 days later. In the fall, females produce overwintering (diapause) eggs. The Service was concerned that the final egg deposition of mosquitoes this summer, if not immediately treated, would then hatch in the spring and continue the cycle of increase. Treatment to reduce the rate of larvae hatching is expected to lower the number of overwintering eggs deposited in the Refuge through reduction in the final mosquito hatch of the season.

This treatment was a refuge use that was allowed under a Special Use Permit (SUP) issued to Coos County Public Health Department (CCPHD). The action was deemed necessary in the wake of a County Health Advisory and a Refuge-based Emergency Declaration due to excessive numbers of mosquitoes being produced on the Refuge, and impacting the health and well-being of local residents. The emergency declaration allowed actions to be taken immediately to abate the situation and protect health and safety of the public while a long-term marsh management solution is developed. The immediate action taken was the application of MetaLarv. This Compatibility Determination was developed promptly following the application.

#### **Availability of Resources:**

The application was conducted under a contract between Coos County Public Health Department and Vector Disease Control International (VDCI). Refuge personnel conducted post-application deposition monitoring which included placing deposition trays in predetermined locations throughout the treatment area and retrieving and analyzing the pellet deposition following treatment. Refuge personnel also conducted post treatment mosquito larvae and adult monitoring to determine efficacy of control.

#### **Anticipated Impacts of the Use(s):**

The purpose of this section is to evaluate how the use could affect the refuge purpose and the NWRS mission; refuge goals, objectives, and management activities; fish, wildlife, plants, and their habitats; the biological integrity of the refuge and the NWRS; other refuge uses; and public safety. The potential direct, indirect, individual and cumulative impacts of the use on Refuge water quality, sediment quality, migratory birds, fish, estuarine organisms, mammals, and terrestrial invertebrates, and the biological integrity of the refuge, are discussed in the Environmental Assessment and Section 7 Evaluation which this Compatibility Determination is appended to and which are hereby incorporated through reference. The potential impacts of the use on the Service's ability to achieve Refuge goals and objectives, as well as potential impacts to other Refuge uses and to public safety, are discussed below. Activities and considerations necessary to mitigate potentially negative direct, indirect, one-time, and cumulative effects are detailed in the section "Stipulations to Ensure Compatibility".

General impacts: The chemical (S)-methoprene mimics an insect growth regulation (IGR) hormone, where its insecticidal activity is based upon interfering with the normal maturation process. In a normal life cycle, an invertebrate goes from egg to larva to pupa and then to adult. (S)-methoprene inhibits the



development by preventing maturation to the adult reproductive stage. At the one-time application rate, this chemical has a relatively short-lived (~42 day) negative impact to target and non-target insects. It may have indirect short-term impacts to non-target insectivorous species by reducing the availability of mosquito larvae and/or adults as a food resource. The chemical itself is not known to directly affect vertebrates at the dose and application rate used for this treatment.

Public Safety: The objective of pesticide treatment, as specified in the SUP and later reduced in scope by Coos County Public Health Department, was to reduce excessive mosquito numbers through control of larval mosquitoes, in order to protect human health and safety. The Refuge allowed the application of MetaLarv to refuge lands following the guidance of the stipulations in the signed Special Use Permit issued to the Coos County Public Health Department under Emergency Authority. The application of MetaLarv is expected to have a positive impact on public safety through the reduction of mosquitoes and their associated health impacts.

Impacts to Refuge Purpose, Goals, Objectives and Management Activities: Bandon Marsh NWR was established for “the preservation and enhancement of the highly significant wildlife habitat ... for the protection of migratory waterfowl, numerous species of shorebirds and fish ... and to provide opportunity for wildlife-oriented recreation and nature study on the marsh.” Refuge goals, objectives and refuge management actions focus on protecting and restoring estuarine, stream-riparian, and forested habitats, as well as providing opportunities for wildlife-dependent public use. The single use of (S)-methoprene to control larval mosquitoes is not expected to have an impact on the Service’s ability to fulfill these purposes, nor to meet the goals and objectives as defined in the CCP.

Impacts to other priority refuge uses:

MetaLarv was only applied to a portion of the Ni-les’tun Unit of Bandon Marsh NWR. At this time the only public use on this unit is wildlife observation from the viewing deck along North Bank Lane and a short trail that leads into the marsh. There were no visitors present at the Ni-les’tun Unit during the application. No priority public uses on this unit or on the Bandon Marsh Unit were interrupted in order to carry out this use. The use is expected to have a positive impact on priority public uses on the refuge through the reduction in mosquito numbers and accompanying health and nuisance considerations.

**Public Review and Comment:**

This use has been thoroughly vetted by the public, the media, Coos County, and Congressional representatives. Following the issuance of a Public Health Advisory by Coos County Public Health, Refuge and Service Regional Office staff discussed potential treatment prescriptions to control the mosquito source population for the remainder of the mosquito season. Participants in the discussion included managers and biologists from other National Wildlife Refuges, vector control biologists with Mosquito Abatement Districts (MAD) and Vector Control Districts (VCD), and technical representatives from mosquito treatment providers that are familiar with salt marsh mosquitoes. The option of pesticide treatment was first brought into the public debate at this time. Jackson County VCD was contacted by Coos County Public Health about the mosquito situation at Bandon Marsh because Coos County has no MAD or VCD. Based upon a request from Coos County, Jackson County VCD provided a proposed mosquito control prescription for Bandon Marsh based upon limited information about the mosquito problem; the prescription involved both larvicide and adulticide treatments. The Coos County Public Health Department released a Draft "Proposal for Mosquito Control on the Bandon Marsh Refuge and Surrounding Area" to inform the public on the proposal and obtain approval of the County Commissioners to implement the plan. Coos County Commissioners and the City of Bandon considered the plan for approval. The County hosted a public meeting in Bandon to hear concerns of the citizens, and subsequently made the decision to use larvicide only on refuge lands. During all this time, Oregon Senators Ron Wyden and Jeff Merkley and Representative Peter DeFazio were kept informed of the situation as it developed.

**Determination:**

☐ Use is Not Compatible

☒ Use is Compatible with Following Stipulations

**Stipulations Necessary to Ensure Compatibility:**

1. Special Use Permittee attends a pre- and post-season coordination meeting with Refuge staff and provides a plan of operation prior to commencement of work.
2. Special Use Permittee agrees to minimize disturbance and impacts to wildlife, fish and habitats.

3. Only Service-approved pesticide is applied on refuge wetlands and only after Pesticide Use Proposal is approved.
4. The permittee is responsible for ensuring that all persons working for the Special Use Permittee and conducting activities allowed by the Special Use Permit are familiar with and adhere to the conditions of this permit.
5. The U.S. Fish and Wildlife Service will have employees / representatives present during all fieldwork.
6. Special Use Permittee coordinates all pesticide application in advance (minimum 24 hours) with Refuge Manager David Ledig to ensure there is no conflict with Refuge management.
7. The Special Use Permittee provides the Refuge with a report of activities under this permit by November 30th. This report shall include a map identifying all treated areas and records of application (dates, site treatment, name of pesticide applied, quantity applied (pounds)).
8. Special Use Permittee agrees to acknowledge Bandon Marsh NWR and the U.S. Fish and Wildlife Service in all written and oral presentations of data collected.
9. An assessment of the on-the-ground deposition will be conducted by Service personnel at 5 locations within the treatment area.
10. Post treatment mosquito monitoring will be conducted by the Service to determine efficacy of control using dip method for larval counts, pupae to adult hatch brooders, and mosquito light traps for adults.

**Justification:**

The Service, in consultation with vector control experts and Coos County Public Health, evaluated all the possibilities for treatment that would be effective in immediately reducing the mosquito population and associated health threat, and inhibiting its recurrence in future years. Of all the options, which included use of non-native fish, increasing bat and bird populations, habitat manipulation, and insecticides, the treatment with the highest combined expectation of success and lowest environmental risk was the application of (S)-methoprene. The (S)-methoprene was applied in mid-September, when shorebird, waterfowl and fish presence in the Ni-les'tun Unit is low, so direct overall effects to wildlife and non-target organisms are expected to be negligible. The Ni-les'tun Unit's public use overlook and parking area were closed only during the application of the larvicide for a short period of time, and concurrently there were alternative facilities available for wildlife viewing, photography, and interpretation on the Bandon Marsh Unit of the refuge away from the treatment area. These factors along with the short duration of treatment, and the expected reduction in mosquito numbers, resulted in an expected minor

overall positive impact on refuge priority public uses. The associated disturbance to wildlife from these activities was observed to be negligible. It is estimated that wildlife populations found sufficient food resources and resting places such that their abundance and use of the Refuge were not measurably lessened from allowing this use to occur. The relatively limited number of individual animals adversely affected by this single application will not cause wildlife populations to materially decline, the physiological condition and production of refuge species will not be impaired, their behavior and normal activity patterns were not altered dramatically, and their overall welfare will not be negatively impacted. Thus, allowing the single application of (S)-methoprene to refuge lands to control mosquitoes, under the stipulations described above, was not expected to materially detract from or interfere with the purposes for which the Refuge was established or the refuge mission.

**Mandatory Re-Evaluation Date:**

\_\_\_\_\_ Mandatory 15-year reevaluation date (for wildlife-dependent public uses)

\_\_\_\_\_ Mandatory 10-year reevaluation date (for all uses other than wildlife-dependent public uses)

**NEPA Compliance for Refuge Use Decision: (check one below)**

\_\_\_\_\_ Categorical Exclusion without Environmental Action Statement

\_\_\_\_\_ Categorical Exclusion and Environmental Action Statement

  X   Environmental Assessment and Finding of No Significant Impact

\_\_\_\_\_ Environmental Impact Statement and Record of Decision

**Literature Cited:**

Extension Toxicology Network (ETN). 1996. Methoprene Pesticide information profile.

<http://ace.ace.orst.edu/info/extoxnet/pips/ghindex.html>

Prepared by:

Deborah Church  
(Signature)11/8/2013  
(Date)Refuge Manager/  
Project Leader  
Approval:B. M. Tule  
(Signature)11/8/13  
(Date)**Concurrence**

Acting

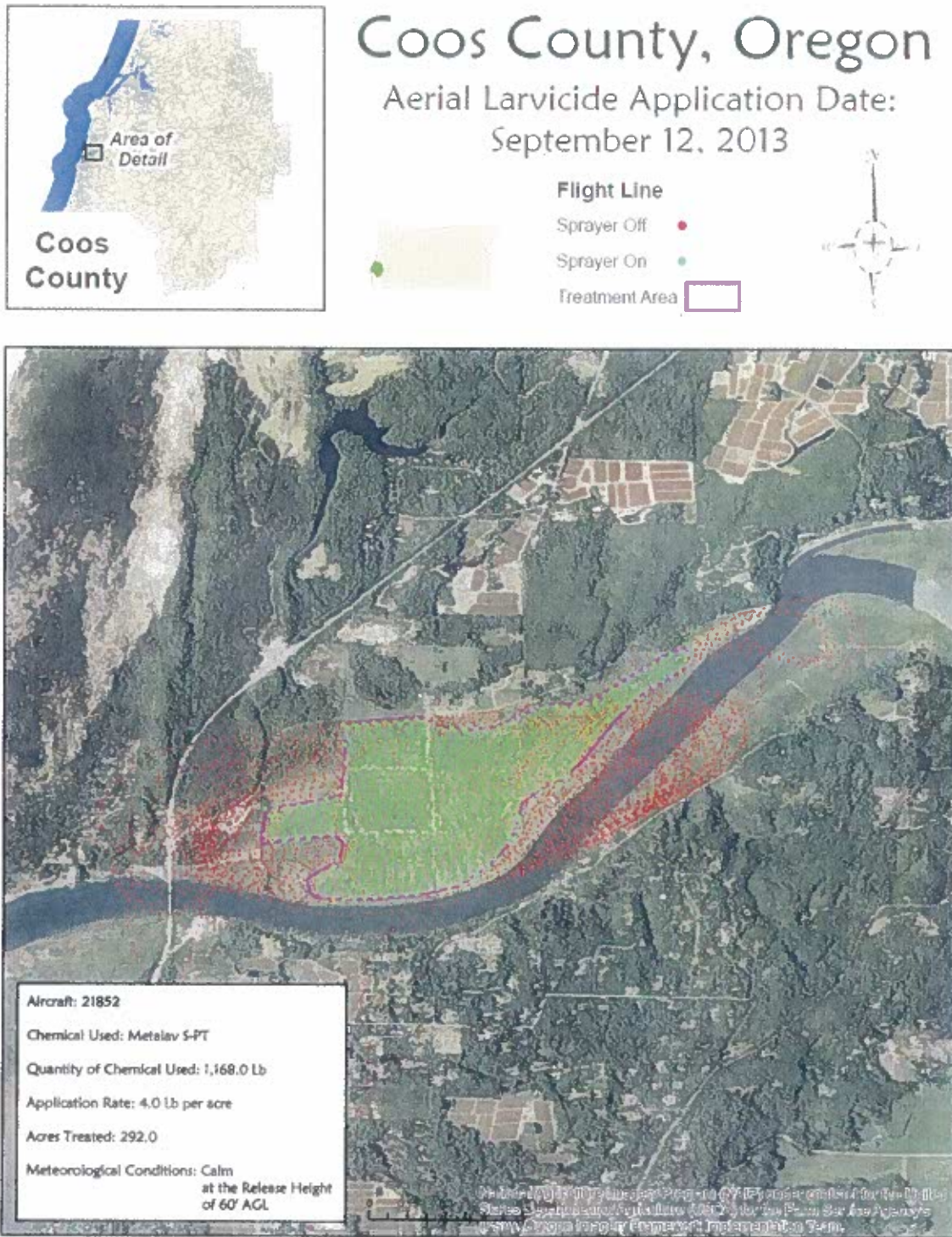
Refuge Supervisor:

Barbara Flansburg  
(Signature)11/8/13  
(Date)

Acting

Regional Chief,  
National Wildlife  
Refuge System:Samuel J. Selbo  
(Signature)8 NOV 2013  
(Date)

Appendix. A Map depicting the MetaLarv S-PT treatment of the Ni-les'tun Unit of Bandon Marsh National Wildlife Refuge on September 12, 2013.



**Endangered Species Act Section 7 Consultation Form  
for**

*Issuance of Special Use Permit to apply methoprene product (MetaLarv) for mosquito control under a county health advisory, Bandon Marsh National Wildlife Refuge, OR*

**File #: R1-13596-2013-S-001**

**Refuge Name: Bandon Marsh National Wildlife Refuge: Coos County, Oregon**

**Refuge Action:** Bandon Marsh National Wildlife Refuge staff issued a Special Use Permit (See Environmental Assessment (EA) Appendix F) for the Coos County Public Health department to apply a combination of insecticides, including both aerial and ground application, targeting larval and adult mosquitoes to the Refuge wetlands and surrounding terrestrial landscape. After further agency and public input, a single chemical, MetaLarv S-PT, an insect growth regulator, was ultimately applied on Refuge wetlands to control mosquito larvae. MetaLarv is only effective on the larval stages of mosquitos. This action was deemed necessary in the wake of a County Health Advisory (EA Appendix D) and a Refuge-based Emergency Declaration (EA Appendix E) due to excessive numbers of mosquitos being produced on the Refuge, and creating a significant nuisance to County residents.

**Part 1**

**I. Project Overview**

**1. Project Location**

Tidal marsh of the Ni-les'tun Unit of Bandon Marsh National Wildlife Refuge, Coos County, Oregon within the Coquille River estuary; approximately 3.5 river miles from the river mouth and 1.5 miles straight line from the Pacific Ocean; Unit Center approximately: latitude 43.153° N, longitude, 124.381° W

**2. Description of the Action**

*Action:*

On 12 September 2013 (1630-1830 hrs), a single-engine fixed wing aircraft (Cessna 188 – Reg. No. 21852) applied MetaLarv S-PT at approximately 4.0 lbs/acre with a Transland Dry spreader to 292 acres of the Ni-les'tun Unit of Bandon Marsh National Wildlife Refuge. The application was conducted under a contract between Coos County Public Health and Vector Disease Control International (VDCI). A total of 1,168 pounds (lbs) of MetaLarv S-PT was applied to the treatment area encompassing known salt marsh mosquito breeding habitat within the Ni-les'tun Unit (see Environmental Assessment Appendix A). Winds were calm with air temperature and dew point of 69°F and 59°F, respectively, during the application. The treatment swaths were approximately 60 feet wide as calculated by the aircraft flight speed of 105 mph and 60-foot release altitude for

the application (See EA Appendix A). An assessment of the on-the-ground deposition (i.e., application rate) was conducted by Service personnel within the treatment area; the median application rate was 3.23 lbs/acre, where 50% of the sampled area received between 2.42 and 4.84 lbs/acre. The desired application rate to control salt marsh mosquitoes was achieved given the 25th to 75th percentile interval from treatment-deposition monitoring contained 4.0 lbs/acre.

MetaLarv S-PT is a US EPA labeled pesticide (Reg. No. 73049-475), which is manufactured by Valent BioSciences Corporation. The MetaLarv S-PT formulation is granular-sized pellets (1-2 mm) that slowly release (S)-methoprene (active ingredient [ai]) up to 42 days for controlling emergence of adult floodwater (including *Aedes spp.*) and standing water mosquitoes. In accordance with the product label, MetaLarv S-PT can be applied to floodwater sites (including salt and tidal marshes) at 2.5-5.0 lbs/acre. It can be applied to mosquito breeding habitat at any time during the mosquito season.

*Action Area:*

The Action Area includes the tidal salt marsh (including some adjacent fresh marsh) section of the Ni-les'tun Unit tidal wetland (See EA Figure 1). Potential impacts are evaluated for the duration of the exposure period, defined as the time from the treatment date (12 September) through late October for an estimated 30-45 day exposure period, based upon the slow-release of (S)-methoprene with residual activity for approximately 42 days provided by MetaLarv S-PT pellets. Due to the relative immobility of (S)-methoprene (described in Environmental Assessment Section IV), exposure to the downstream estuary and marine environments is considered insignificant. The following narrative considers habitats and species that were present and potentially exposed during the time the (S)-methoprene was expected to be active, i.e., 12 September through approximately the end of October 2013 (42 days).

In 2011, the Ni-les'tun Unit was restored, allowing the natural processes of tidal flow and sediment deposition to return to the former diked pastures where tidal flows had been blocked for nearly 100 years. The goal of this large-scale (over 400 acres) restoration effort was to restore natural processes (tidal exchange, salinity, natural temperature regimes), which in turn create the desired terrestrial and aquatic habitats, allowing native fish, wildlife, plant, and invertebrate species to return to the site. The restoration project involved restoring and creating over five miles of meandering tidal channels and filling nearly 15 miles of drainage ditches. The project also removed nearly two miles of dikes and three tidegates that had blocked the tides from entering the historic wetlands and two freshwater salmonid-bearing streams. The creation of sinuous tidal channels and re-meandering of straight-line ditched tributary creeks is now allowing unimpaired exchange of water and sediment between the project area and the Coquille River.

The estuarine salt marsh and tidal flats of the Ni-les'tun Unit contain rich beds of algae, marine invertebrates, and plant life that support wading birds, migratory



waterfowl, and shorebirds, which in turn provide an important prey base for numerous raptors including the recently delisted bald eagle and peregrine falcon (USFWS unpublished data). In addition, the sinuous tidal channels and mudflats, twice flooded by daily tides, provide essential habitat for numerous marine species of fish including starry flounder, surf smelt, and shiner perch, as well as important nursery habitat for anadromous species such as Chinook and coho salmon, steelhead, and coastal cutthroat trout.

Information about the habitats and species potentially affected by the larvicide treatment is presented in detail in the Environmental Assessment. The majority of the birds present in the Action Area during the exposure period are transitory migrants, such as shorebirds and some waterfowl, and winter residents that are arriving, such as other waterfowl, raptors, waders, and passerines. Sampling along permanent streams flowing through the marsh, tidal channels, and the mainstem of the Coquille River show use of the marsh channels by salmonids and estuarine species such as surf smelt, surf perch, and starry flounder; however, very low numbers of salmonids occur within the marsh during the exposure period due to seasonally warm temperatures (USFWS unpublished data). Aquatic species such as shrimp, crab, and jellies were known or likely to be present in the marsh during the exposure period.

Additional description of the properties and action of Metalarv S-PT; pre and post treatment monitoring; and resulting effects to non-listed species and habitats are discussed in the Environmental Assessment which this Compatibility Determination is appended to and which is hereby incorporated through reference.

### **3. Project Timeline**

The issuance of the Special Use Permit allowed the application of insecticides from the date of issuance (26 August 2013) until the cessation of the mosquito outbreak, with an expected termination of need by 31 October 2013. Aerial application of the pesticide MetaLarv S-PT to control larval mosquito instars occurred on 12 September 2013, between 1630-1830. This timeframe was chosen to minimize impacts to non-target invertebrates.

Due to the persistence of this product, approximately 42 days, this was a one-time application.

### **4. Federally Listed Species and Critical Habitat**

The updated list (01 Aug 2013) contains Endangered Species Act (ESA) designated species under USFWS jurisdiction for Coos County, OR and was obtained from the USFWS, Oregon Fish and Wildlife Office website. Consultation for ESA designated species under the jurisdiction of NOAA-Fisheries is currently ongoing.

#### **A. Listed species and/or their critical habitat:**

1. Marbled murrelet (*Brachyramphus marmoratus*) – threatened
  - a. The species is not known or expected to utilize the action area.
  - b. Critical Habitat does not include the Ni-les'tun Unit of Bandon Marsh National Wildlife Refuge
2. Western snowy plover (*Charadrius alexandrinus nivosus*) - threatened
  - a. The species is not known or expected to utilize the action area.
  - b. Critical Habitat does not include the Ni-les'tun Unit of Bandon Marsh National Wildlife Refuge

**B. Proposed species and/or proposed critical habitat:**

No known proposed species occur within Coos County, OR.

**C. Candidate species<sup>1</sup>:**

No known proposed species occur within Coos County, OR.

**Part 2 – Informal Consultation**

**II. Effects Analysis**

The chemical MetaLarv S-PT, an insect growth regulator, inhibits the ability of larval mosquitos and other insects to undergo successive instar development and ultimately prohibits transformation of mosquitos (and other insects) into adults. At the one-time application rate, this chemical has a relatively short-lived (~42 day) negative impact to target and non-target insects. It may have indirect short-term impacts to non-target insectivorous species by reducing the availability of mosquito larvae and/or adults as a food resource. The chemical itself is not known to directly affect vertebrates at the dose and application rate used for this treatment.

1. Marbled murrelets occur off-shore of the Refuge within marine waters where they forage. Murrelets may potentially fly over the Ni les'tun Unit as they return to nesting sites further inland, however, at the time of application, nesting season had been completed. They have not been recorded along the Coquille River in the vicinity of or on the Ni les'tun Unit and are not known to feed within shallow estuaries with any regularity. Because they are deep-water marine feeders, they would not be expected to feed on mosquito larvae. Marbled murrelets at either an individual or population level would not have been affected by this treatment.
2. Western snowy plover occur along the coastal beaches on and adjacent to the Refuge. This species is generally confined to ocean shorelines and adjacent dunes. It would not be expected to utilize the Ni les'tun Unit wetlands due to their being

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<sup>1</sup> Include state-listed species here if they are to be evaluated through the Section 7 consultation.

located about 1.5 miles straight-line distance from occupied coastal habitats. Critical habitat for this species occurs along the coastal strand but does not extend inland to the Unit. There are no documented records of snowy plover on the Niles'tun Unit, and there is only one 1 documented record of a snowy plover on the Bandon Marsh Unit since the refuge's establishment in 1983 (14 August 2002). Snowy plovers at either an individual or population level would not have been affected by this treatment.

### III. Effects Determination and Response Requested:

#### Determination

##### A. no effect/no adverse modification

species: marbled murrelet status: T  
species: western snowy plover status: T  
critical habitat: N/A

##### B. may affect, but is not likely to adversely affect species/adversely modify critical habitat

species: \_\_\_\_\_ status: \_\_\_\_\_  
species: \_\_\_\_\_ status: \_\_\_\_\_  
critical habitat: \_\_\_\_\_

##### C. may affect, and is likely to adversely affect species/adversely modify critical habitat

species: \_\_\_\_\_ status: \_\_\_\_\_ \*

species: \_\_\_\_\_ status: \_\_\_\_\_ \*

critical habitat: \_\_\_\_\_ \*

##### D. may affect, and is likely to adversely affect species/adversely modify critical habitat

species: \_\_\_\_\_ status: Proposed \*\*

species: \_\_\_\_\_ status: Candidate \*\*

proposed critical habitat: \_\_\_\_\_ \*\*

\* *Formal Consultation is required, check the appropriate concurrence statement below and sign; then proceed to Part 3, Section IV (Formal Consultation).*

\*\* *For Proposed Species and Critical Habitat, or Candidate Species a conference with Branch of Refuge Biology staff is required; a Formal Consultation is not required.*

Rebecca Chuck  
Signature of Preparer

11/8/13  
Date

**Evaluation by Project Leader:**

1. *For A & B above:* Concurrence   X   Non-concurrence \_\_\_\_\_
2. *For C above:* Formal consultation required \_\_\_\_\_
3. *For D above:* Conference required \_\_\_\_\_

  
\_\_\_\_\_  
Signature of Project Leader

11/08/13  
Date